PC

The Independent Guide to IBM Personal Computers

Volume 1 Number 6 $3.00

Getting the Most out of Your IBM Personal Computer

USING THE PC TO REVISE THE BIBLE!



REVIEWS
of UCSD p-System,
Concurrent CP/M,
IBM COBOL, and
The Programmer.

PLUS -
Writing Data Files,
How to Copyright
Your Software, Tips
on Memory Expansion,
Setting Up an Executive
Work Station, and an
Introduction to RatBAS, a
Language for Structured
BASIC Programming.

Making The Elephant Tap Dance

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"Yes, it's my new IBM... but wait till you see how fast it runs my favorite CP/M programs!"



It's nice learning to use your own IBM P while getting ready for all of the excitin programs that are being developed for i But it's doubly nice to know that the va array of CP/M programs can run now.. while you're waiting.

The Byad DS1 Expansion Circuit Boa provides a Z80B microprocessor and th CP/M operating system enabling you to CP/M programs faster and better than ev

This speed is the result of dual proces operation wherein the IBM 8088 proces and memory become an intelligent, inter driven, fully buffered Input/Output syste using direct memory access transfers t and from the Z80 host processor. When running under PC-DOS or CP/M 86, the Byad Expansion Circuit Board provides 64K of dynamic RAM memory.

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Just plug in Byad, sit back, and enjoy the wait.

BYAD

Byad, Inc.
101 Lions Drive
Barrington, Illinois 60010
312 381-2330

System Requirement
Minimum requirement 48K RAM, sing diskette drive, monochrome display. A tionally second diskette drive, double-s drives, parallel printer, asynchronous c nications adapter. 64K RAM on system and user configured I/O devices are supp

Hardware
Memory—64K x 9 bit dynamic RAM.
Processor—Z80B with clock cycle of 4.7 mHz with no wait-states. Z80 communicat with the 8088 using interrupt structure of the IBM-PC. DS2 version also includes a serial port with current loop and RS232 and RS422 interfaces.

Software
Digital Research Corp. CP/M 2.2 (suggested retail price $150) configured for a 64K memory system, includes CP/M utilities.
Byad Utilities:
SETUP — System configuration—number of disk drive buffers, size of printer, communications buffers and other system parameters
FORMAT — Formats and writes system files to diskette
COPYDISK — Backup utility for single or dual drive system
FILECOPY — Single drive file copy
FILEX — Copies files compatible with the IBM drives
TRANSFER — Moves files between two CP/M systems using serial interface
Comprehensive operating manual including schematics, installation procedure, theory of operation and operating instructions.



CP/M is a registered trademark of Digital Research. IBM is a registered trademark of International Business Machines Corporation. Suggested Retail Prices: DS1—$660, DS2—$760

material



Microsoft's RAMCard™ with RAMDrive™ takes the whir, click and wait out of the IBM PC.

Solid State Disk. When you add the Microsoft™ RAMCard to your IBM® Personal Computer, you also add RAMDrive, which lets you use memory as you would normally use a disk. That gives you "disk access" that's typically 50X faster than disk. Without the whirring, clicking and waiting of mechanical data access.



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More tools for IBM. Microsoft wrote PC-DOS, the standard operating system for the IBM Personal Computer. And Microsoft is first in providing a full range of languages, applications programs and utilities for the IBM PC. The addition of RAMCard with RAMDrive is our way of saying that Microsoft will continue to offer more and better supported tools for the IBM PC.

See for yourself. Ask your Microsoft or IBM PC dealer for a demonstration of both main memory and disk features of the Microsoft RAMCard with RAMDrive. It's solid state memory you can also use like a disk. And it takes the whir, click and wait out of the IBM PC.

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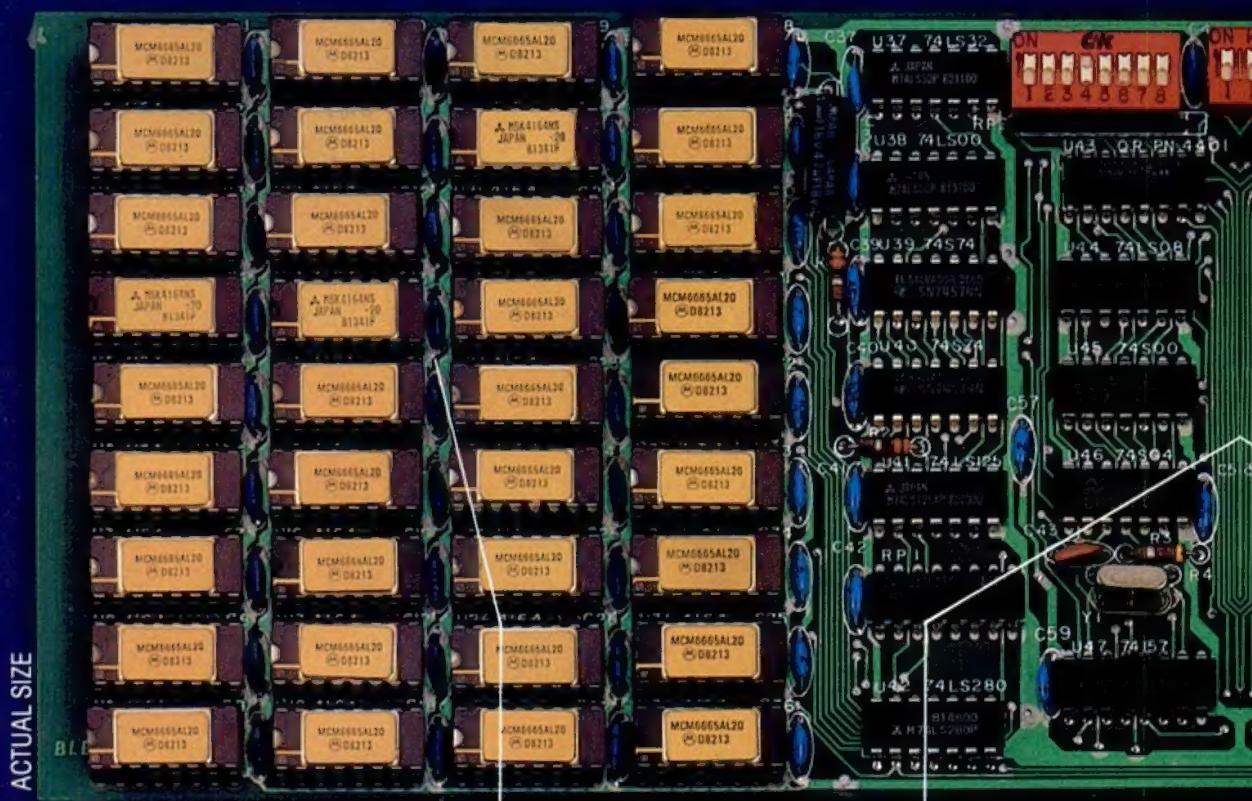
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PROVEN DESIGN.
Quadram has been shipping IBM boards with each of the Quadboard functions on separate boards since December, 1981. They are still available as separates (including a Dual Port Async Board) for those who desire a quality board but do not need to keep slots open for future expansion. And they all come with a one year warranty from the leader in technology applications.

256K MEMORY EXPANSION.
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v with Quadram's extremely flexible con-
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v with IBM hardware, operating systems,
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d board that can be inserted into any free
e system slot and it even includes a card
e edge guide for securely mounting the
o card in place.

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with 64K Installed



R PARALLEL PRINTER I/O.

A A 16 pin header on Quadboard is used
t for inserting a short cable containing a
e standard DB25 connector. The connector
i is then mounted in the knock-out hole
l located in the center of the PC back-
q plane. The parallel port can be switch
o disabled or addressed as Printer 1 or 2.
M No conflict exists with the standard
q parallel port on the Monochrome board.
T The internal cable, connector and
r hardware are all included.

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Using the same chip as that on the IBM ASYNC board, the device is software programmable for baud rate, character, stop, and parity bits. A male DB25 connector located on the back connector is identical to that on the IBM Async Adapter. The adapter is used for connecting modems, printers (many letter quality printers require RS232), and other serial devices. Switches allow the port to be configured as COM1 or COM2 and the board fully supports IBM Communications Software.

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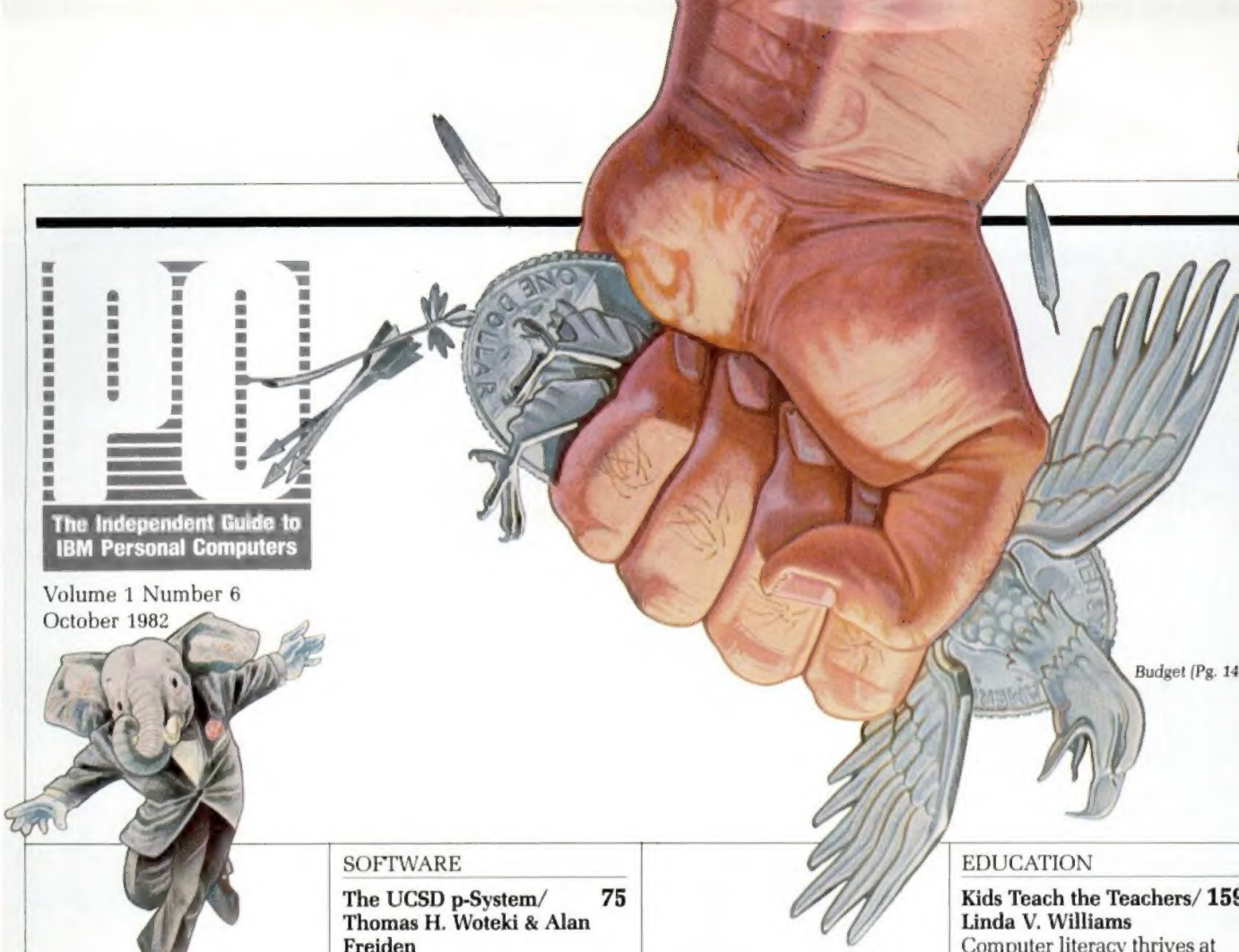
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4357 Park Drive / Norcross, Ga. 30093

The Independent Guide to IBM Personal Computers

Volume 1 Number 6
October 1982



Budget (Pg. 14

In This Issue

PC INTERVIEW

A PC Revises the Bible/ Cheryl Woodard **50**
Father Woodard and his parishioners welcome an IBM PC to the congregation.

EVENTS

PC Goes to the US Festival **223**
A photo essay.

FINANCE

Winning the Battle of the Budget/Andrew Williams **146**
Preparing your personal budget according to a 12-month plan.

IBM EYE

Making the Elephant Tap Dance/Jim Edlin **63**
IBM's marketing support representative, Hal Jennings, creates software that's hard to forget.

SOFTWARE

The UCSD p-System/ Thomas H. Woteki & Alan Freiden **75**
Portable, personal, and professional. A potential gold mine at a substantial price.

Concurrent CP/M-86/ David B. Hughes **88**
Using this operating system with a minimum of hardware can quadruple the results.

PC Reviews IBM COBOL/ James H. Cowden **96**
A distinguished name in compilers, IBM COBOL gets the crown of approval.



PC Profiling/Peter Rowley **102**
One system to make your programs run faster.

Using Data Files/ B. Boasso **109**
Part 2: Random Access. Some refining techniques for writing and adapting your own data programs.

A Solution to the EDLIN Blues/Steve Leibson **115**
PC reviews *EDIX*, a versatile text editor that harmonizes with the PC.

RatBAS Basics/William F. Sharpe & Brent D. Weaver **121**
A rational solution to the problems of BASIC.

A Program Tool for the Programmer/Karen Phillips **131**
PC reviews *The Programmer*, a shortcut to speedier programming in BASIC.

EDUCATION

Kids Teach the Teachers/ Linda V. Williams **159**
Computer literacy thrives at Stanford as kids teach the professors a few tricks.

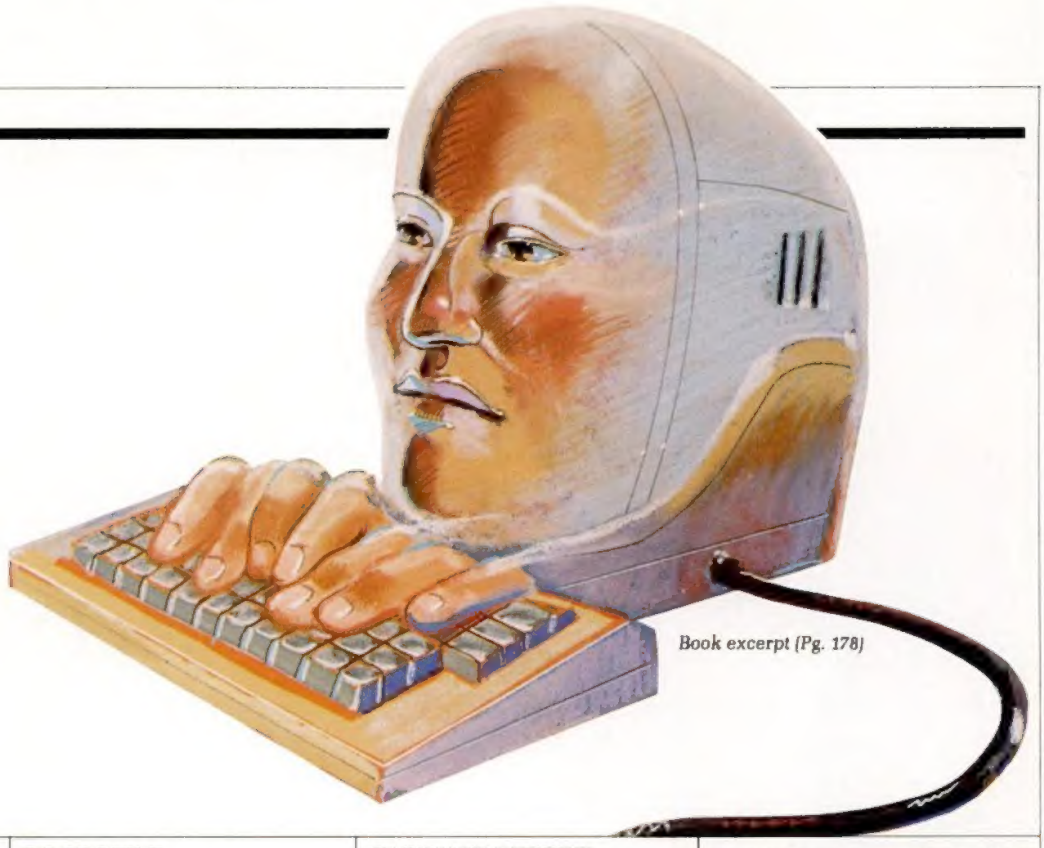


RAM (Pg. 232)

LEGAL

How to Copyright Your Software/Daniel Remer **168**
You can safeguard your inventions against the software bandits.

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Book excerpt (Pg. 178)

BOOK EXCERPT

Humanizing Technology and Computerizing People/H. Dominic Covvey & Neil Harding McAlister **178**
Computer Choices: Beware of Conspicuous Computing.

FIRST PERSON

Making an Executive Work Station/James C. Becknell **204**
A first-hand report on the growing pains of a Texas consulting firm.

PC PROFILE

The PC Comes of Age for Architects/Jeremy Joan Hewes **211**
An architectural innovation that makes drafting tables defunct and computer-aided blueprints the design of the future.

BOOK REVIEW

Practical BASIC Programs/Les Cowan **219**
Forty programs in BASIC.

PRODUCT REPORT

The What, Where, and How of RAM/James Creane **232**
Memory expansion surveyed: prices, popular products, and co-processors that help personalize your system.

AGE OF ALTAIR

The Keys to the Kingdom/ David Bunnell & Eddie Currie **289**
Part V reveals a mysterious visit from an investigator in pinstripes and the beginning of a long trek up.

COLUMNS

David Bunnell **23**
Take Charge of Your Pachyderm

Zero Base Thinking/Jim Edlin **25**
C. S. . . .

DEPARTMENTS

Letters to PC **15**
P-Communiques **29**
PC Tutor/Bob Rice **36**
PCartoon **141**
User-to-User/Andrew Fluegelman **245**
Club News/Susan Hurley **271**
Communications Briefs **275**
PC Directory **277**
New on the Market **299**
Index to Advertisers **316**
Wish List **320**



Copyright (Pg. 168)

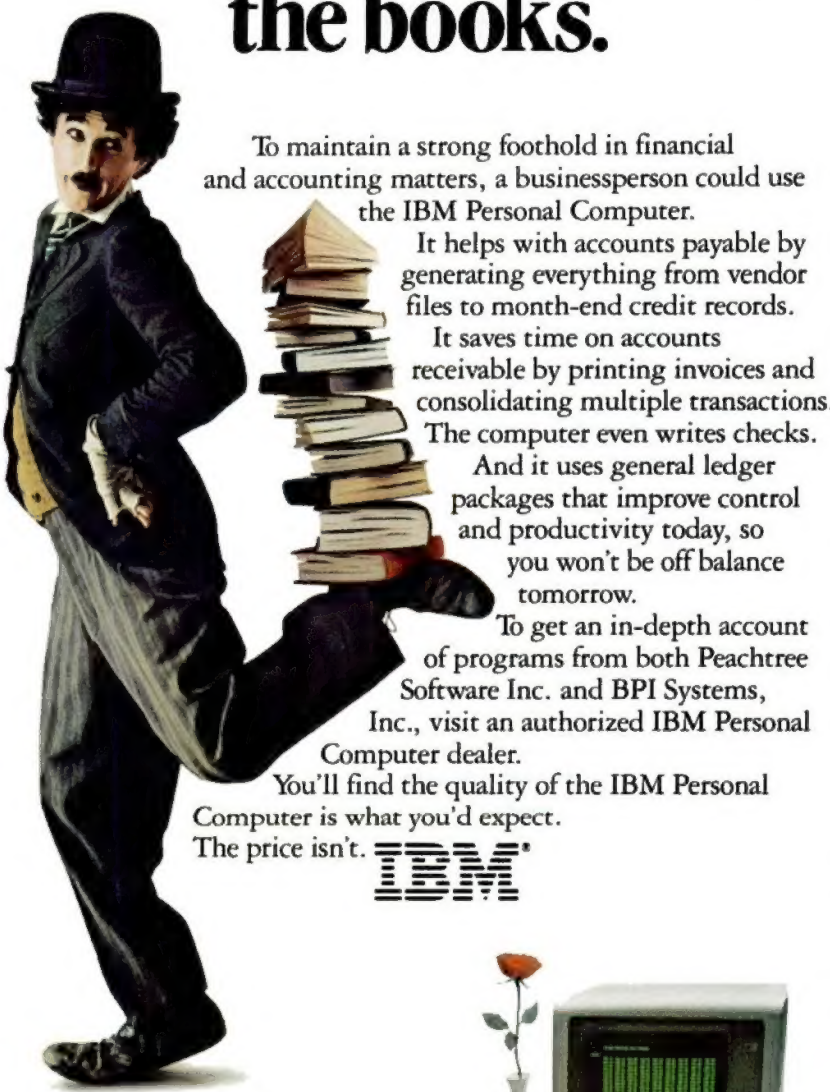


COVER

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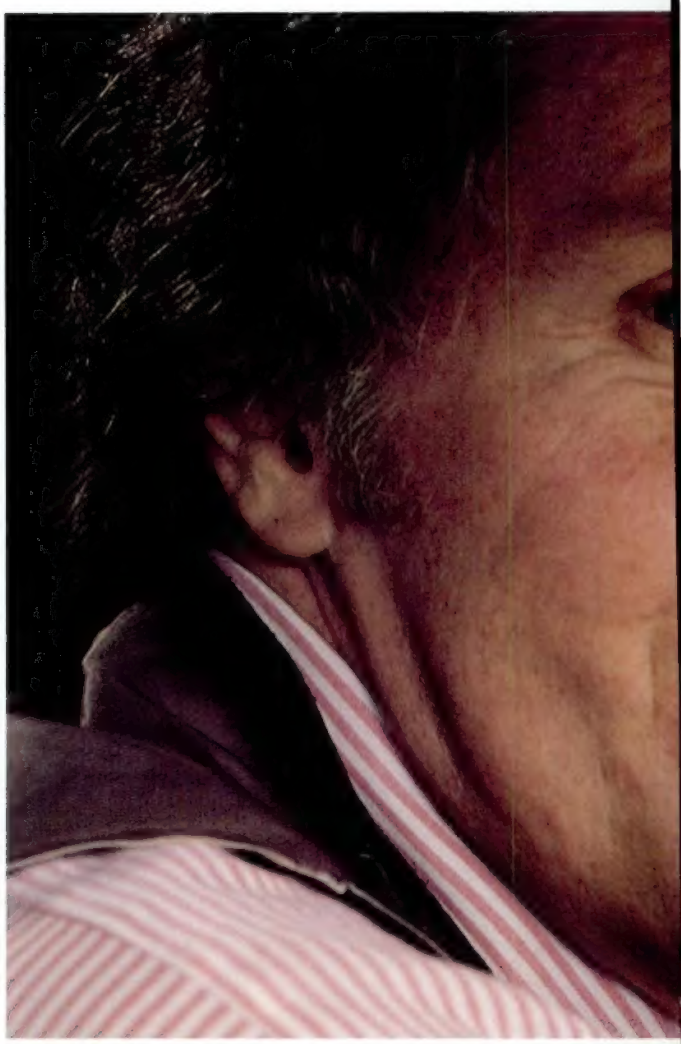
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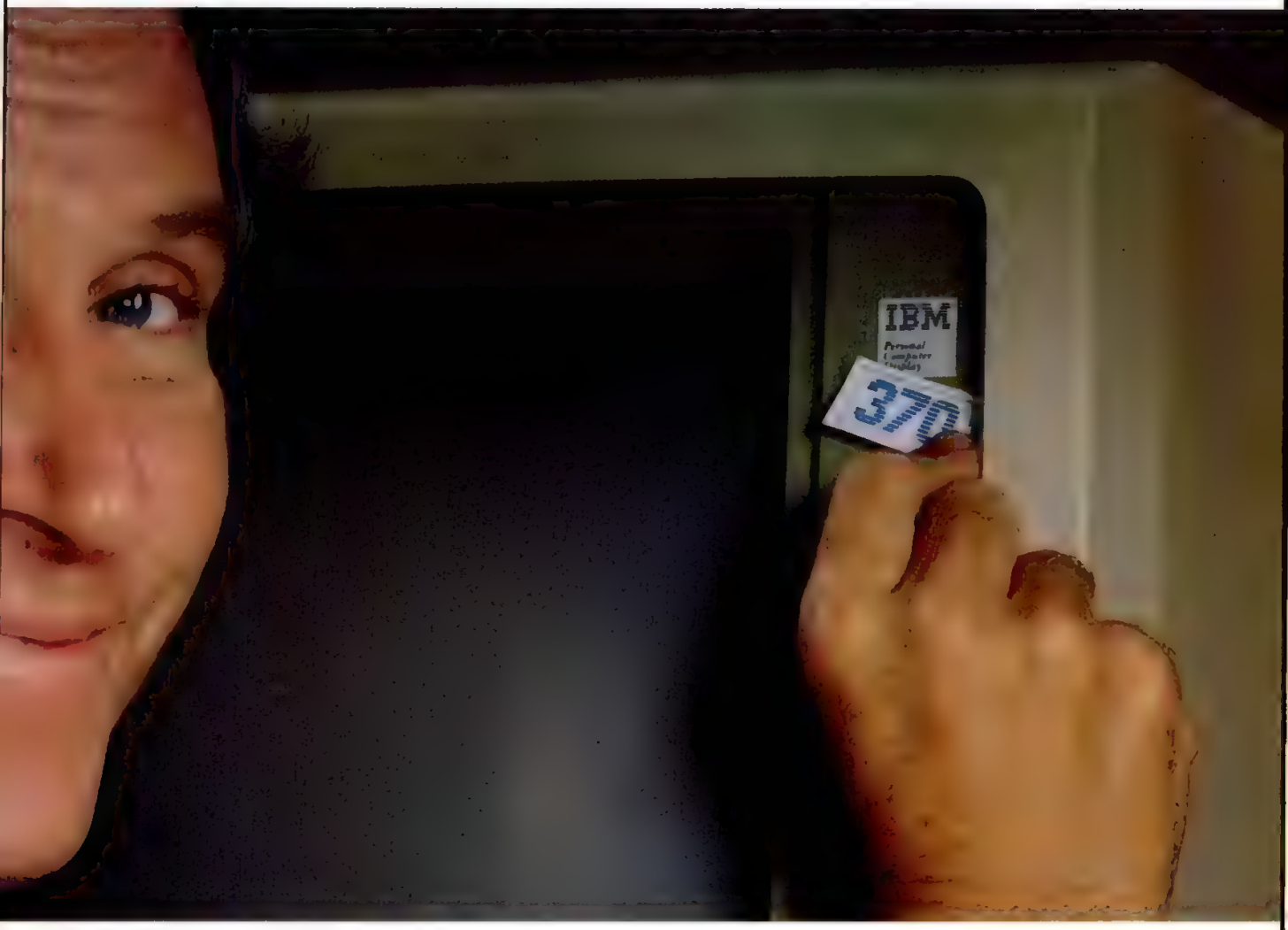
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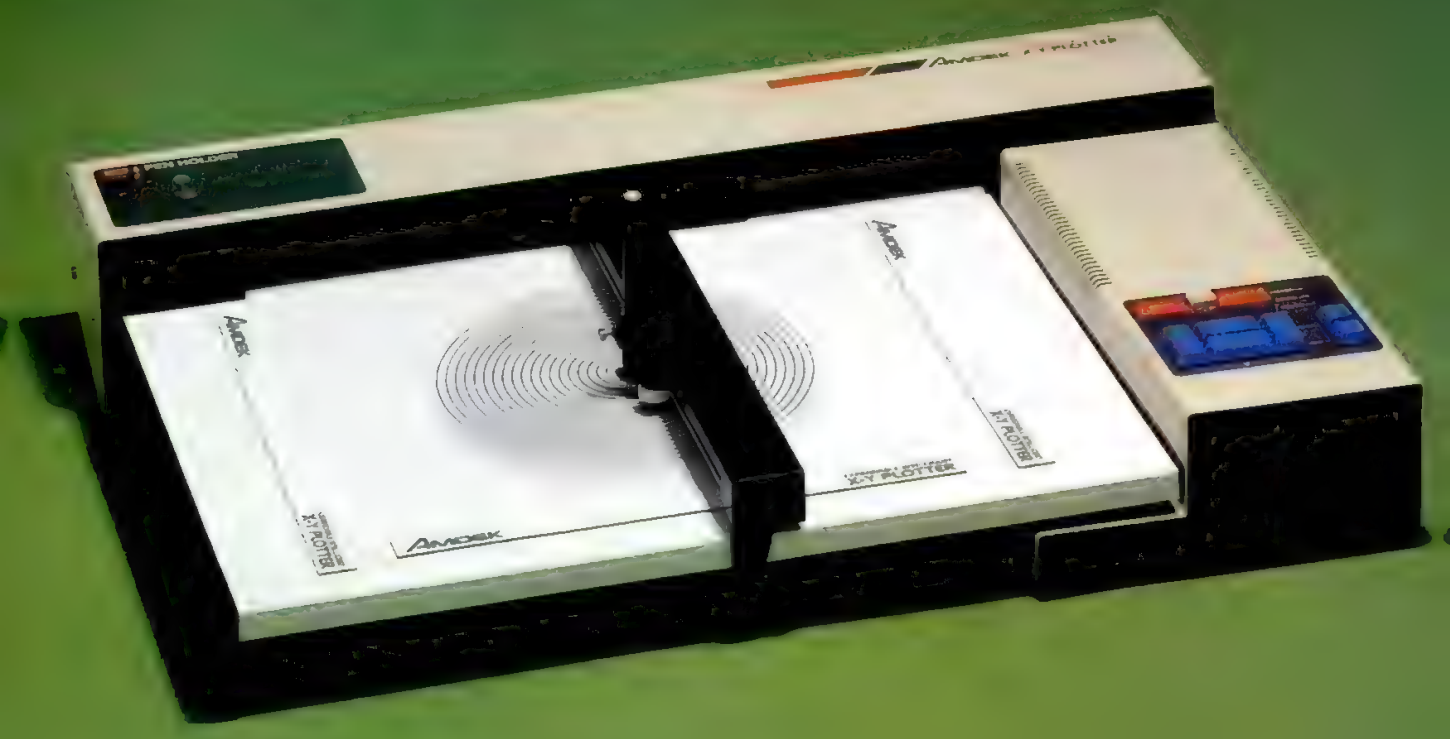
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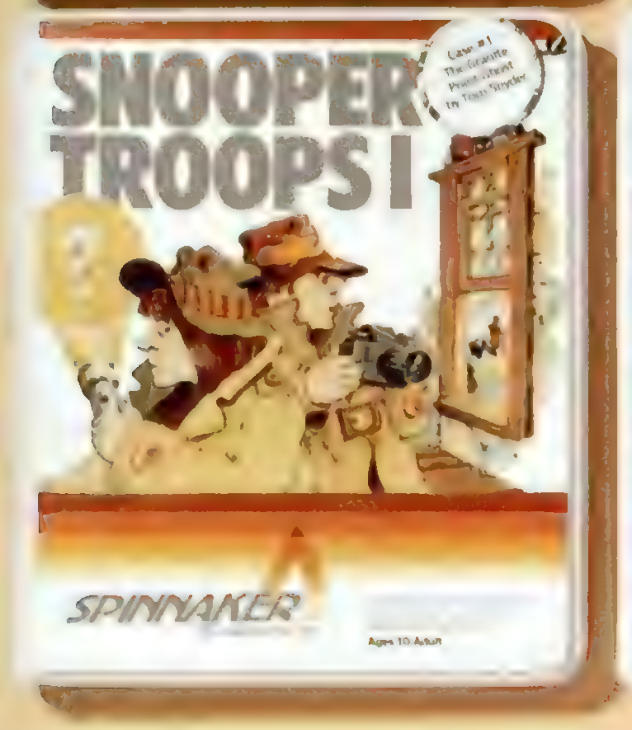
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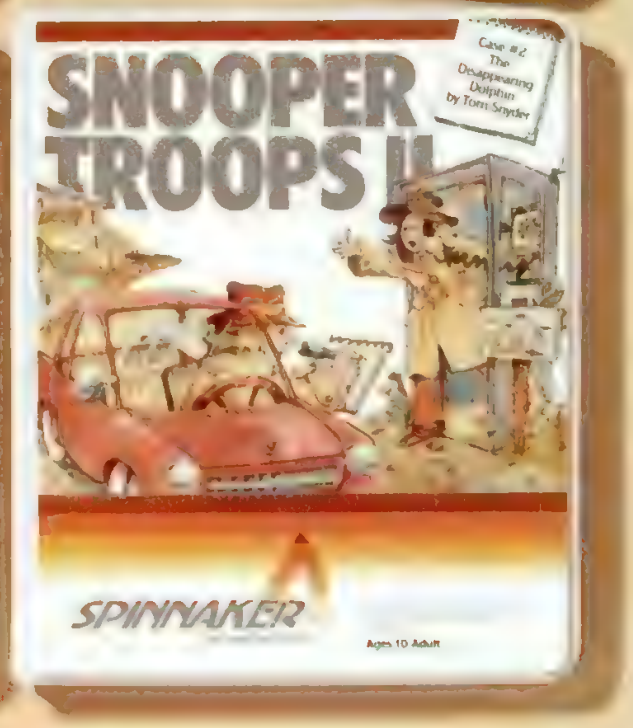
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At Spinnaker Software, we make educational games that are actually fun.

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And because your children use them, they'll be learning. And after all, isn't that what educational games are all about?

Our games are educational, because you can't kid parents.

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Our games make the computer screen come to life. With colorful graphics, animation and sound.

And they're easy to use. In fact, a lot of our games are easy enough for kids who've never even used a computer before.

How do we make our games both educational and fun?

We're glad you asked.

Educators and game programmers write our software.

Educators, because they've been in the classroom and know how children learn. And what it takes to keep their interest.

Game programmers, because they know how to have fun with computers. These programmers give our games the high resolution graphics, animation and sound that make them so entertaining.

And right now, we're introducing four new games that can be played on the most popular computers, Apple,® Atari,® and IBM.®

First, there's FACEMAKER. It's for young computer users, kids ages 4-8. FACEMAKER helps children improve memory and concentration and provides familiarity with the computer.

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Personal computers are full of promise. Context makes them deliver. ©Copyright 1982 Context Management Systems

Letters To PC

Anachronistic Programs

Regarding Jim Edlin's column "PC Power" (*PC*, June/July, 1982), I agree that well-designed programs will thoughtfully exploit the resources of the PC. I trust your own software reviews will point out to prospective purchasers the lapses in judgment that result in anachronisms such as those he cites. You owe it to us to label software that does not exploit PC power, and warn us not to buy it.

Michael Ham
Iowa City, Iowa

We point out exceptional features and flaws, but we will never say "don't buy product X" simply because it doesn't exploit all the PC's features. —Ed.

In the Dark with Data

"Three Communications Go-Togethers" (*PC*, June/July, 1982) has an error. The Smartmodem is based on the Z8 microprocessor chip and not the Z-80 as was stated in the article.

Thanks for *PC* magazine: I have really enjoyed it. However, I did not get much out of the article entitled "Using Data Files." I still seem to be in the dark about data files and would not mind seeing some more on sequential files, especially before proceeding on to random access files.

Ray
Source: TCL724

Book Review Reviewed

For some months I've been muttering to myself about that wretched Goldstein book, *IBM Personal Computer*. When the August, 1982 issue of *PC* arrived, I quickly turned to the books section, figuring your reviewer would warn prospective *PC* newcomers to steer clear of this one. I was stunned to find it billed as "A Tool for the Layperson."

This book has more errors than I have ever seen collected between two covers and should be enough to thoroughly confuse any layperson who encounters it. Worse yet, the extensive errata sheet ignores some errors and repeats others. Such inattention goes a long way toward making this book a dangerous weapon in the hands of an inexperienced user such as myself.

John M. Woram
Rockville Centre, New York



P-System

I have owned the UCSD p-System since the day it first went on sale at the San Diego ComputerLand. So far my attempts to obtain assistance from IBM and ComputerLand for problems in the p-System and in its documentation have been unsuccessful.

After years of dealing with IBM on mainframes, I'm used to silent treatment and the "IBM knows best but won't tell you" tactics. I had hoped they'd unbend a bit with the PC. You'd think a company as big as IBM would have the corporate self-confidence to admit the possibility that bugs might exist in their software.

Despite my complaints, I think that of all the languages the p-System takes fullest advantage of the advanced features of the PC. It has a unified operating system in the best sense. DOS is a mixed set of interpreter and filer commands with little sense of systematic design. CP/M can be loved only by patient system programmers who like serving machines instead of vice versa.

The p-System already offers concurrent execution, print spooling, an excellent editor, and the ability to segment code so that large programs can be run.

Ron Belanger
San Diego, California

See our review of the p-System in this issue.—Ed.

Really Lost

I'm planning to buy an IBM PC and am about to go bonkers. I know less than nothing about computers. I know only that I need one. I've decided to buy the IBM primarily on the recommendation of a couple of friends who are systems analysts on big IBM equipment.

We have only one source for the IBM PC in the Kansas City area as far as I know— ComputerLand. They either don't know a great deal about what's available in the way of substitute parts or they don't want to tell me. I bought your magazine and discovered a wide variety of available products. Now I'm really lost. I don't have anyone to talk to who can help me sort out what I need.

William Sharp
Kansas City, Missouri

Perhaps you should contact your nearest user group or bulletin board. The September issue's PC Product Guide includes a list of user groups, clubs, and bulletin boards.—Ed.

Conversion Confusion

I am extremely pleased with my new copy of *EasyWriter 1.10*. The authors have improved its performance, its ease of use, and its reliability. I have, however, found one problem your readers will be interested in if they are changing from version 1.0. The "convert" program makes the follow-

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Letters To PC

ing transforms when converting Version 1.0 text to Version 1.10: ".space0" becomes ".SPACE1"; ".SPACE0" becomes ".SPACE1"; and ".SPACE1," ".SPACE2," etc. are not transformed.

The documentation says this change was made in the new version, but this statement offers little consolation for those of us with multiple files to convert. The change is enough of a difference that I have to edit each of my Version 1.0 files for proper spacing. Overall, Version 1.10 is excellent.

Phil Mader
Wichita, Kansas

MBA Review

My business was a test site for Context Management Systems' *MBA*. I have had the first production version for about 3 weeks. In your brief review of the *MBA* (*PC, Marketplace*, June/July, 1982), you seemed favorable to the product but said it suffered from being a "jack of all trades, master of none." I think you have missed the point of the *MBA*.

MBA is not just a "combo" program. It is the first of what I would call true "management software." It fully supports the multifaceted functions performed by a manager.

A software user who specializes in only one of the areas included in the *MBA* (spreadsheet, graphics, data base, word processing, or communications) may require a specialized program that runs faster or has additional features in one of these areas. However, for the manager who wants to assemble and analyze data, make decisions, and communicate management information quickly and easily, the *MBA* may well be the single most useful software tool he or she could have.

W. T. Dippel
Lancaster, Ohio

Displaywriter Advocate

I subscribed to *PC* in hopes that your magazine may come to fulfill a useful role for those of us who own IBM's Displaywriter. The IBM word processor is a fabulous machine for creating text, and it can run CP/M-86 and CBASIC-86. No other magazine has taken notice of this computer even though it is the dominant dedicated word processor in today's market.

Dennis Meadows
Hanover, New Hampshire

Off and Running

After months of study and agonizing consideration, your magazine convinced me that IBM PC is the way to go. I took delivery this week and I'm off and running. My copy of *PC* (June/July, 1982) is dog-eared from reading and rereading, and I'm sending for a subscription.

Patrick M. Thayer
Makakilo, Hawaii

More Facts

Andrew Fluegelman's "EasyWriter Resurrected" (*PC*, August, 1982) was nice but inadequate. I am a first-time computer buyer who would like to compare *EasyWriter*, *Volkswriter*, and *WordStar* in terms of ease of use and features. But your article leaves me at a loss.

Phrases such as, "Some may prove sweeter and more nutritious" are poetic but hardly help me decide what to buy. Why not do a simple chart comparing features, ease of use, and speed. I liked what you wrote but I need more facts.

Joel Leenaars
Richmond, California

Look for our November issue. It features word processors.—Ed.

Not So Simple

Burks Smith (*P-Communiques*, June/July, 1982) is absolutely correct that the PC is an ASCII machine. However, his comment, "The fact that the PC uses the Intel 8088 microprocessor ... makes it a strictly ASCII machine," is nonsense. The 8088 processor does not preclude the use of EBCDIC or any other character code.

Smith also mentions that if you wanted to connect the PC to an IBM computer that didn't communicate in ASCII code, "it would be a simple matter to write a program for the PC that would do the conversion." This is true as far as it goes, but there are far more difficult problems to overcome than the matter of code conversion. Smith's comments show he isn't familiar with IBM communication protocols.

Ed Sawicki
President, Micro Development
Lake Oswego, Oregon

PC DOS Wins One

The account you gave of the origins of MS-DOS (PC-DOS Wins One," PC, June/July, 1982) is incorrect. MS-DOS was originally written by Seattle Computer Products under the name 86-DOS. Microsoft modified 86-DOS for the PC and in late 1981 bought the rights to 86-DOS from SCP for distribution as MS-DOS. PC-DOS does not have some of the utilities of MS-DOS, and some 86-DOS utilities are not distributed with most copies of MS-DOS.

Erik Magnuson
Escondido, California

Hal Glatzer, who wrote "PC-DOS Wins One," was referring to the conversion of a data point system to make it PC compatible. Mike Orr, who converted the system, had formerly been employed at Microsoft as the article stated.—Ed.

The Bithood Question

I was surprised to find a significant number of errors in "The Bithood Question" (*PC*, August, 1982). The article seemed helpful at first. I had not seen a discussion that succeeded in defining the differences between contemporary 8-, 16-, and 32-bit processors. But I was disappointed.

One of the article's most glaring errors is its attempt to classify a processor based on the size of the data path between the processor and its associated memory. A

Letters To PC

processor should be classified solely by the characteristics of the processor itself; its memory system is a separate entity.

Consider the Intel 8086 and 8088 processors. Both are considered 16-bit processors. They are essentially identical except that the 8088 transfers data back and forth between memory 8 bits at a time while the 8086 transfers data 16 bits at a time. According to the definition in your article, one would have to say that the 8088 is an 8-bit processor, which it most definitely is not.

The article claims, "An 8-bit microprocessor is limited to 64K RAM." This is a very misleading statement. It is certainly possible to design an 8-bit microprocessor architecture that can address more than 64K bytes of memory.

Later it says, "A 16-bit microprocessor, such as the one inside the IBM PC, can handle binary addresses up to 16 places long and can work with up to 262,143 memory locations, abbreviated 256K RAM." Close, but no cigar. The 8088 processor in the IBM PC can address 1,048,576 bytes of memory.

Part of a very interesting sentence reads, "...such as the DEC PDP-10, which has several 16-bit processor chips working together." There may be processor chips used somewhere in a DEC-10, but every DEC-10 made uses discrete components to implement the central processor unit. To say that the DEC-10 CPU employs several processor chips to implement its processing function is not true.

The Cray and CDC supercomputers are not 32-bit architectures. In fact, the Cray-1 is a 64-bit architecture, and the CDC supercomputers are primarily 60-bit architectures. Finally, no existing computer architecture has ever satisfactorily simulated a three-dimensional weapons performance model of suitable practical complexity.

James B. Morris
Delphi Computing Consultants
Beaverton, Oregon

PC Bugs

The PC is a swell computer, but it isn't perfect. IBM's "Dow Jones Reporter" does not work with the Hayes Stack Smartmodem. If IBM does not come out with an answer to this problem, I will have to get an acoustic modem, another asynchronous port, another cable, and another phone cord and modular plug. (Or I could buy just the modem and spend a few minutes plugging and replugging everything every time I want to use the program.) I wrote to IBM about this and got thundering silence.

Despite the helpful information in *User-to-User* (*PC*, August, 1982), I cannot get my 7730 Spinwriter to obey any shadowtype, subscript, bidirectional, boldface, or underline instructions. It obeys the boldface and underline instructions in *EasyWriter* 1.1, but that's all. I have tried everything, including the instructions for the 3530 Spinwriter in *User-to-User*.

Harvey A. Dodd
Manchester, New Hampshire

Look for Andrew Williams' article on the Dow Jones Reporter in the November issue. Regarding your second item, Intertek makes an interface for later model Spinwriters to correct the problem you mentioned. To find about retrofit possibilities, contact Intertek, 790 Lucerne Dr., Sunnyvale, CA 94086.—Ed.

Calc Wars

I enjoyed "Calc Wars" (*PC*, August, 1982). Andrew Fluegelman did a good job of comparing the two spreadsheet systems that have the largest market share.

We will start shipping *Target MasterPlanner* and *PlannerCalc* for the IBM PC within several weeks. *MasterPlanner* is a full-fledged financial modeling system. In addition to spreadsheet capabilities, it includes powerful commands, English notation, a flexible report writer, broad fomatting capabilities, a run-time INPUT statement, complete consolidation and related capabilities, simple line and column commands to eliminate the need for replication, and the ability to interface with word processing systems. *PlannerCalc* is a subset of *MasterPlanner*—its models and data can be read and processed by *MasterPlanner*.

Donald J. Devine
Group Vice President
Comshare Inc.
Ann Arbor, Michigan

I didn't think much of "Calc Wars" in *PC*'s August issue. The degree to which the writer tried not to offend either side was offensive to me. The conclusion that both spreadsheets are good (each with its weaknesses and strengths) and that a decision is a matter of personal preference made me wonder why the article was written. I think your writers would be well-advised to take a more definitive position instead of wishy-washy, even-handed treatment of controversial issues.

Michael Ham
Iowa City, Iowa

This is probably not the first letter you have received concerning Andrew Fluegelman's article on *VisiCalc* vs. *SuperCalc* in the August 1982 issue of *PC*. At first I found the article informative and interesting; however, as I got deeper into the discussion, it became obvious that Fluegelman was comparing *SuperCalc* to the *VisiCalc* that came out in 1978. It certainly wasn't the *VisiCalc* I use.

For example, I can put up to 134 characters of formula or test in each of my *VisiCalc* cells—not 76 as Fluegelman suggests.

Fluegelman says *VisiCalc* does not have the option to suspend automatic recalculation as does *SuperCalc*. This is incorrect. (I suspect the editors of *PC* have not used *VisiCalc* because they chose to support Fluegelman's misleading statement by putting it in bold type in the center of the page.)

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"Significantly faster (than EasyWriter 1.1). — Andrew Flugelman, PC Magazine.

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Letters To PC

Probably the most frustrating part of the article dealt with *VisiCalc*'s speed. I attempted to duplicate Fluegelman's "torture test," which was difficult since he didn't outline what he did clearly. Following his example, I built a model in which each cell calculated the value of the preceding cell multiplied by 1.01, with the only data entry cell being A1. I did this for all 254 rows of 12 columns to get "over 3,000" multiplications (3,048). I then put a summation formula in the 13th column, which added the values in the preceding 12 columns for each of the 254 rows. I set the model up to calculate by rows instead of columns. My results follow.

VisiCalc's remaining memory was 104K, suggesting that the model consumed 110K (214-104)—more than the 92K in Fluegelman's test. Calculation of the model took 1 minute, 4 seconds versus the 2 minutes, 6 seconds quoted by Fluegelman. The model was saved in 1 minute, 40 seconds. The model was loaded in 3 minutes, 5 seconds. Recalculation took another 1 minute, 4 seconds, and I was ready to use my model in 4 minutes, 9 seconds compared to Fluegelman's 6 minutes, 25 seconds.

There may be hardware differences that account for the speed discrepancies I found. I purchased an IBM PC in April 1982. It has 256K (the standard 64K with a 192K expansion board from Seattle Computing). I used extended *VisiCalc* (256K version) and DOS 1.10.

Darrell E. Boomgaarden
Louisville, Kentucky

Andrew Fluegelman's "Calc Wars" (*PC*, August, 1982) is an excellent comparative review. He didn't mention, however, that *VisiCalc (VC)* completely loads (the VC disk can be removed after loading), whereas *SuperCalc (SC)* requires the program disk to be on an active drive. Various *SC* commands are slightly delayed while the small program module needed for the command is loaded. I find this annoying because while I wait the screen shows that I have 277K memory available for worksheet expansion.

Fluegelman's comments on the GOTO command might be misunderstood. When GOTO is used to a cell already on the screen, *VC* and *SC* work the same. Only when GOTO is used to scroll the screen is there a difference. I prefer the *SC* GOTO, as I sometimes work on three problems with A1, M1, and Z1 as the home positions. The *SC* GOTO moves me from one problem to another with the working screen always in the same relative position.

John W. Menne
Floral City, Florida

In my review of VisiCalc *vs.* SuperCalc *I indicated that every time a new entry is made on* VisiCalc *the entire worksheet is recalculated. As many readers were quick to point out, such is not the case. The command "/GR" allows you the option of manual or automatic recalculation. —A.F.*

Corrections

Our sincere apologies to United Peripherals, maker of the Universal Hard Disk featured in the "NCC Roundup" (*PC*, August, 1982). We mistakenly described the disk as a product of Practical Peripherals. For information on the device, contact United Peripherals at (408) 733-4200.

Our apologies to Leading Edge, the up-and-coming company from Masachusetts, for having identified the company as being located in New Jersey in *PC*, August, 1982.

Several major errors appeared in my short review of the IBM Pascal Compiler (*PC*, August, 1982). I failed to notice that the debugging command defaulted to on rather than off, so the tests were run in debugging mode. The primary effect of that oversight was to increase execution speed dramatically. The benchmark that required 76 seconds with debugging on ran in 9 to 12 seconds (depending on exact coding) with debugging off. Debugging also affected compile time, though not as significantly. For example, the longest compilation was cut from 7 minutes, 22 seconds to 6 minutes, 19 seconds.

I failed to point out that program sizes were for EXE files, which include both the 8192-byte flag array and header information used by the loader. The implied comparisons to CP/M programs were not parallel. Turning off debugging also cut EXE file sizes slightly.

The conclusions of the article need to be modified. I said the compiler had significant extensions that made it a powerful systems programming tool, that it was not for beginners, that a hard disk or double-sided drives are needed for serious development work, and that program size is large. With apologies, I amend those conclusions by adding that the execution speed is excellent and that program size is better than indicated.

Larry Press

Drop of a Pin

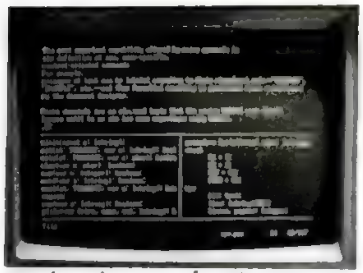
There is a pin number error in my letter "Upgrades to 16 Bits," (*PC*, August, 1982). In the procedure for using MPI B51 disk drives with the IBM PC references to pin 34 should be to pin 32 (SIDE SELECT). Also pins 7 and 8 (Head Load with Motor) can be jumper-connected on the shunt socket of the MPI drives instead of pins 1 to 14 (Head Load with Drive Select). Either way will work.

Kim Lignell
Addison, Illinois

Letters to the editor may be sent to PC *electronically through The Source or CompuServe.*

Source: *ST0948*
CompuServe: *70305,532*

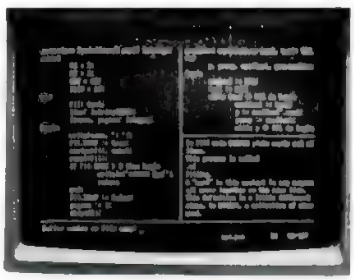
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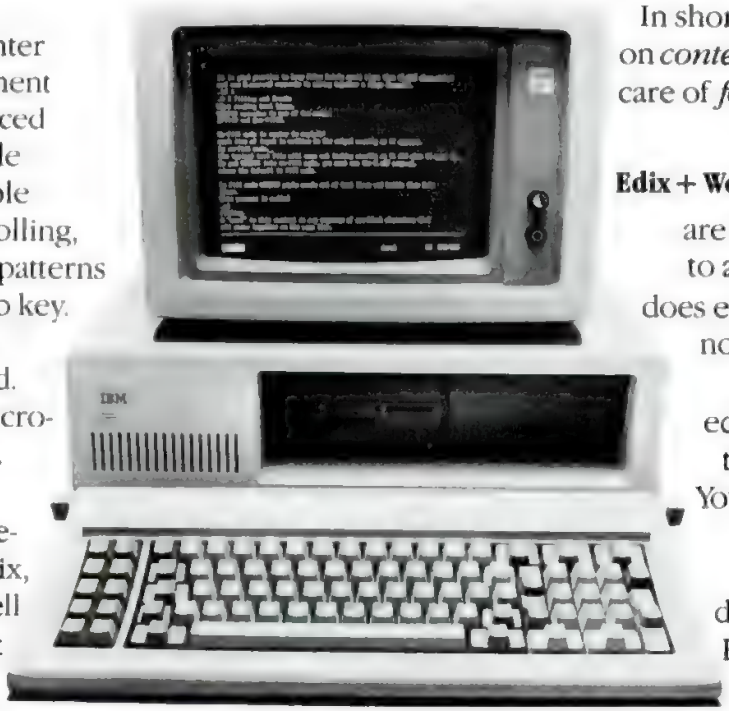


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Take Charge Of Your Pachyderm



Last month's PC listed and described over 1,250 products for the IBM Personal Computer. In addition to hardware, systems software, and support items there was a total of 584 programs. The IBM PC has come a long way since it was first delivered about a year ago.

The IBM PC is destined to become the best-supported computer of the 1980s. But it's not there yet. Among personal computers, the Apple II is still *numero uno* in terms of volume of available applications programs, accounting for continued high sales.

Don't misunderstand. The IBM PC is vastly superior to the Apple II. The Apple II is a throwback to the ancient 8-bit world, which was populated by clumsy micros with puny memories. Although it remains, hands-down, the best 8-bit seller, the Apple II is barely adequate. Many other 8-bit beasts are thrashing about the jungle with full 80-column screens, 128K of memory, and improved designs.

Sooner or later the IBM PC will blast past the Apple II like a runaway locomotive overtaking a solar-powered bicycle. But stoking up the PC engine will require some really smart people. Not all them will be IBMers. As always, software is the key. Too many of the programs available for the IBM PC are battered remnants of the 8-bit world. Programs from this era are characterized by user unfriendliness, limited file size, and lack of everything but marketing hype. The 8-bit world had plenty of hype.

In 1978 the nation's media were loaded with stories about the wonderful new personal computers that would soon be making our breakfasts and balancing our checkbooks. People seemed fascinated by the notion that personal computers could somehow be used to control everything from toasters to lawnmowers. They assumed that programming a toaster was simply a matter of hooking it up to a personal computer and instructing it to toast the bread according to specifications at exactly the right moment, say 15 minutes after the morning shower. The shower, of course, would also be controlled by the computer.

THE 8-BIT world was populated by clumsy micros with puny memories.

Today we know that personal computers are better suited to applications such as word processing, business planning, task scheduling, and communications. We can take our own showers.

Thanks to the pioneers who pushed their 8-bit computers to the limit, we know which direction to travel. Now that our 75,000 readers know what's available to make their IBM Personal Computers truly powerful, it's time to refine our cute little gray, metal pachyderms. It's time we teach them to tap dance.

This issue of *PC* should help speed up the process. We've selected for review some of the systems software and programming tools that will lay the foundation for truly powerful 16-bit programs. Even if you have no intention of learning how to program, awareness of these tools is important. By knowing what a "concurrent" operating system is, you can begin thinking of ways you might want to take advantage of its ability to run more than one program at a time.

With personal computers there are magical moments when everything works right and the beast does something poetic. However, even with the new 16-bit species, the technology has a long way to go before it can reach out to the average consumer. Personal computer owners are still a special breed. We come from all walks of life, but we are more daring than our peers, more interested in pushing out the frontiers of our professions. Most people play video games and watch endless hours of video pablum. The average person probably isn't patient enough to learn how to format diskettes. As Jim Edlin reports in the editorial that follows, personal computer users have to put up with a lot of C.S.! **/PC**



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ZERO BASE THINKING/JIM EDLIN

C.S. And What To Do About It



Illustration: Mick Wiggins

Suppose you were offered the chance to spend 8 days in an uncomfortably confined space with only stale air to breathe, primitive bathroom facilities, barely palatable food, a likelihood of other nauseating conditions, and material risk to life and limb. Sounds like a good offer to pass up, doesn't it?

Now suppose you were offered that same deal with the additional explanation that by enduring it all you would be able to visit the Moon. Having no other way yet to get to the Moon puts a different perspective on the idea.

In a nutshell, a fundamentally similar choice at a less extreme level has faced every person who has decided to use a personal computer. Pioneering implies hardship. And the decision to include a personal computer among your tools or diversions is, even today, a pioneering act. Attendant hardships used to be greater but some are still present. The hardship often comes as a need to put up with what I call "C.S.," the computer version of the barnyard substance abbreviated "B.S." People sometimes attempt to glorify the endurance of C.S. by calling it "Computer Literacy," just as the barnyard substance is occasionally gussied up by calling it "fertilizer." But Gertrude Stein would tell you it is B.S., or C.S., just the same.

C.S. is impedimenta such as having to squeeze your identifying label for a disk-stored program or data file into a code phrase of fewer than a dozen letters, such as SLSDEP3Q.VC. To you that file may be the "Sales Department 3rd Quarter Forecast" data for your *VisiCalc* program, but if you want to discuss it with your personal computer, you'll have to do so with an obscure reference such as the one above, and be sure to type it perfectly at that.

C.S. is having to decide in advance about the maximum size of each information tidbit you'll want to store in a data file. No sooner do you decide to have your computer keep a file about your customers, say, than your data file program will demand to know the size of the longest customer name you ever intend to store. You had better either anticipate now that you might someday do business with John Jacob Jinglehammer-Smith or be prepared to offend him by truncating his name in the event he does happen by.

C.S. is having a program tell you "Type 'Y' for 'yes' or 'N' for 'no' " in response to a question, and then having to stare at the keyboard for several seconds ferreting out that dratted "Y."

C.S. is having to go find a format program every time you buy a new box of storage disks, and then blowing 10 minutes or more fooling with the disks before you can use them.

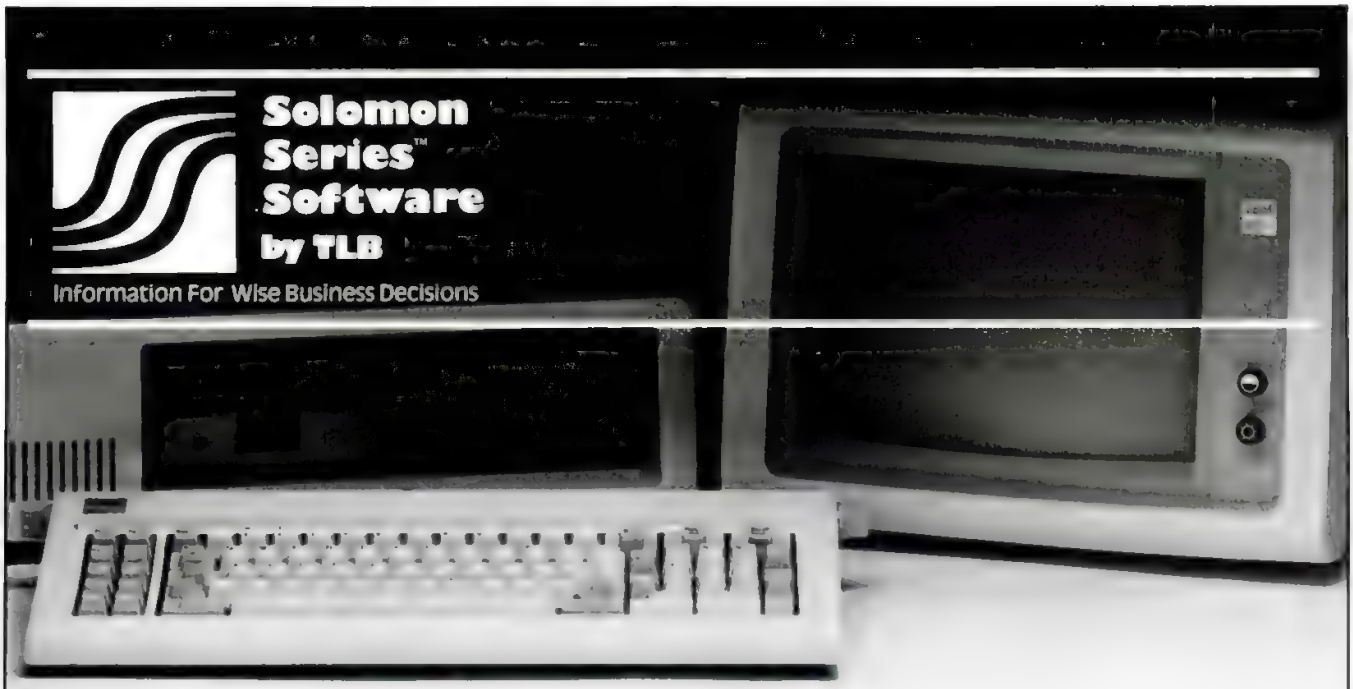
C.S. is wanting to send some important data file by telephone to someone else's computer and having to slog your way through niceties of baud rate, stop bits, parity, and protocols before you can make the transfer.

If you have a personal computer and your olfactory sensibilities have not already been dulled by being around them for years, you know where the C.S. lies. If you are planning to acquire a personal computer soon, you will certainly find out.

The advice of this column regarding C.S. is somewhat schizophrenic. As the moon flight example illustrates, B.S./C.S. becomes deplorable only when it survives longer than the need for putting up with it. Until then it is regrettable, and ignorable if the incentives are powerful enough.

I believe efforts to shovel away C.S. lag deplorably behind elimination of the justifications. I think a lot lingers due to complacent acceptance by computer professionals so inured they no longer recognize what is objectionable. I am inclined to urge your unbending intolerance of C.S.—that you hoot and point and "vote with your feet" by refusing to step where it lies.

But another voice tells me to set aside questions of where C.S. removal is overdue, and urge computer newcomers not to be intimidated by its presence. By ignoring and enduring some C.S., you will gain access to substantial powers of a sophisticated tool, and perhaps a compelling diversion as well. Above all, I exhort you to experiment playfully and without inhibition. So long as you are always careful about having spare copies, on spare disks, of all your programs and data files, it is nearly impossible for experimenting to cause any lasting harm. Experiment! Press keys whose purpose you don't quite understand. Program a line or two or ten in a language that still seems mystical to you. Plow through the pages of instruction manuals that still seem largely incomprehensible. Explore beyond your everyday programs and see what happens. In the process you just might get started on a trip to the Moon. */PC*



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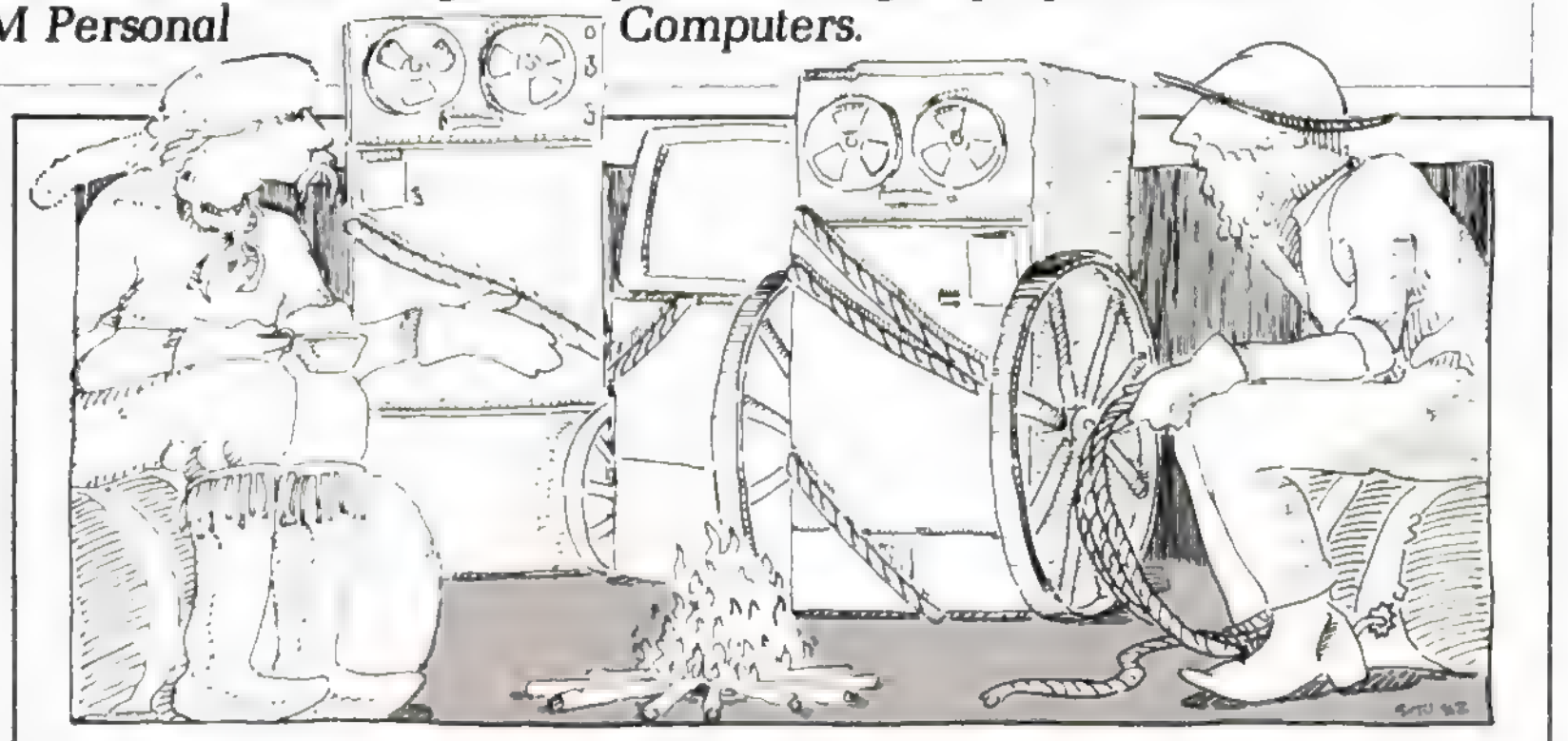
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P-Communiques

A compendium of facts, news, inside intelligence, opinions, gossip, speculation, and forecasts about IBM Personal Computers.



Computer Folklore

P-Communiques is initiating a new department, "Computer Folklore," which will be devoted to the history, myths, and lore of microcomputers. We want to record the human stories, accidental discoveries, coincidences, and recollections of the formative days of this technology explosion. We also hope to assemble the folk tales and legends of the micro world, whether or not they are strictly accurate, so that this industry can celebrate its own Paul Bunyans and Huck Finns, as well as the whizzes from Homebrew and Intel. Any contributions will be appreciated, with credit and a modest payment to authors of published items.

Here's our first bit of folklore for readers' reactions, contradictions, corrections, or embellishment. According to legend, the Winchester hard disk's name does not derive from an inventor or marketer named Winchester, but from a nickname associated with the original model number when this type of hard disk was developed by IBM. That number was 3030, also the designation for a classic rifle made by the Winchester gun company. Someone who knew about the 30-30 rifle dubbed this hard disk the Winchester and the name stuck. Can anybody verify, debunk, or add to this bit of micro lore? Please send all responses and folklore items to *P-Communiques*.

Micro Marketing Newsletter

If you are developing software for the PC or other microcomputers or you plan to enter this potentially lucrative business, the *Micro Software Marketing* newsletter may be for you. It's a monthly publication of news, advice, and industry information designed to assist those who create, package, and market software for microcomputers. Among the tips in a recent issue of *MSM* were several mailing lists of microcomputer owners and magazine subscribers, advice on selling to foreign markets, suggestions for effective advertising, an update on software piracy lawsuits, and a news squib about IBM requiring software houses, such as MicroSoft and VisiCorp, to sign a secrecy pledge in order to get advance technical information about the PC. (The PC secrecy agreement was 10 pages long.)

To subscribe to *Micro Software Marketing*, write to P.O. Box 380, Congers, NY 10920. The annual subscription rate is $48.

P-Clarification

P-Communiques welcomes contributions from readers, and we print the contributions that we find noteworthy and useful to the PC community. Lately we've also had some questions about items previously published in P-Communiques. Seems it's time for another declaration regarding the contents of this column.

The P-Communiques Declaration: We print items if we have a reliable source, and we label them according to the degree of certainty they inspire. If we mention "rumors" or "speculation," they are just that. We include complete information about each item when available; we're not holding back details just to make your mouths water. Please keep those cards and letters coming, but don't assume we know more than we're telling. What we know is what we tell—guaranteed.

One other mistaken notion that persists in some quarters is that *PC* magazine is somehow associated with IBM. We are not. *PC* is an independent publication, unaffiliated with IBM or any advertisers appearing in this magazine.

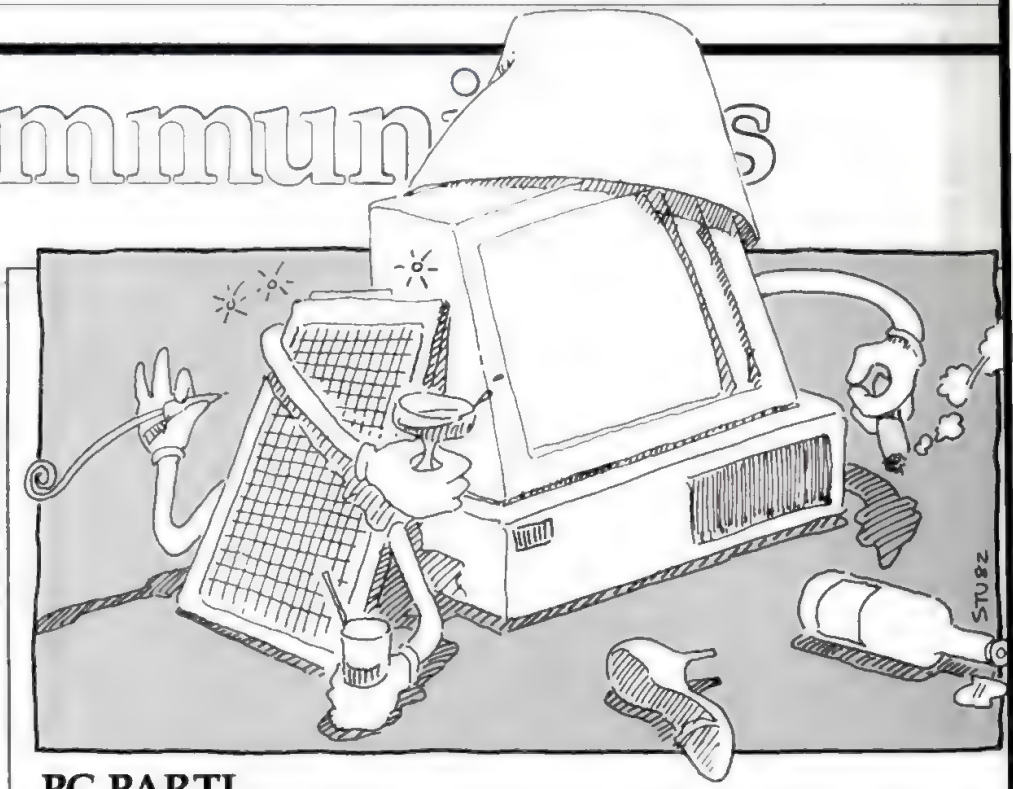
Small Investments

In this era of tumbling prices for big-ticket items such as memory boards and disk drives, makers of small electronic aids have followed suit. Two gadgets designed to prevent damage to electrical equipment resulting from problems with the power supply could be useful in any computer environment. The first is a plug-in circuit tester, which can be purchased for less than $10 at most hardware or electrical supply stores. A molded plastic plug-like device, it has three prongs on one side and three tiny light bulbs on the other. When plugged into an outlet, the circuit tester's lights show whether that outlet is properly grounded and, if not, which of five error conditions exists in the outlet. With this inexpensive tester, anyone can determine if it's safe to use a particular outlet for a computer or other equipment.

The second gadget is the new Voltage Spike Protector manufactured by Archer ($9.95 at Radio Shack). This device is plugged into a three-prong outlet and the equipment is plugged into the other end. The spike protector is designed to filter any power surge or spike in the line, preventing an extra burst of electricity from reaching, and possibly damaging, the computer.

Illustrations: Stuart Bradford

P-Communications



IBM Announces Science Micro

We now have evidence of what IBM can do with a microcomputer when it wants to, and this new micro may offer a glimpse of future enhancements for the PC. IBM Instruments Inc., a scientific division of IBM (Orchard Park, P.O. Box 332, Danbury, CT 06810), has announced the IBM Instruments Computer System (model 9000), a modular microcomputer system that features the 8 MHz 68000 microprocessor; 128K RAM (expandable to 5 megabytes); ROM expandable to 128K; and high-resolution graphics and text on a 12-inch CRT. This system will support four disk drives that may be 5¼- or 8-inch floppies, or 5- or 10-megabyte hard disks.

This computer is definitely designed for laboratory use. The keypad unit has 57 user-definable keys and six LEDs. The three RS-232C serial ports, one IEEE 488, and one 8-bit parallel port provide connections for scientific or other peripheral devices. A real-time clock is supplied complete with backup battery and three 16-bit timers.

The standard computer system includes a multitasking operating system, I/O drivers, graphics routines, and diagnostics. All this costs $5,695. The options are many. One 5¼-inch double-sided disk drive may be mounted in the computer cabinet (price, $650). In a separate cabinet, one 5¼-inch drive costs $795, and the second is $650; 8-inch drives in a cabinet are $1,495 for the first and $975 for the second. A 5-megabyte hard disk costs $2,495; 10 megabytes is $2,695; and the disk controller is $1,295.

This super system is obviously not cheap, but it does demonstrate the bells and whistles available for IBM micros. We'd love to know if anyone out there is using one of these machines.

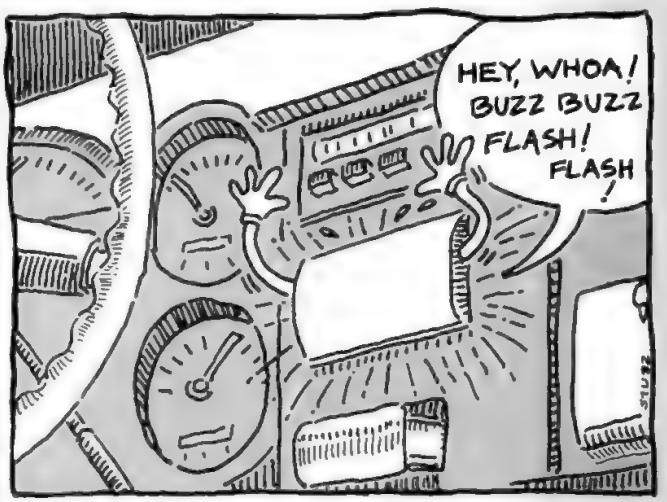
PC PARTI

In addition to its well-established PC bulletin board, The Source has initiated a new service called PARTI, a "conference" system that allows subscribers to establish public or private message exchange services. Any Source user may create a subgroup with PARTI, and at least two such groups devoted to the PC are flourishing. If you want to sample these conferences, join the groups, or start your own special interest conclave, type PARTI at the ">" prompt. Good instructions are available, including a practice conference to demonstrate the structure of branching messages.

If you wish to go directly to the PC section of PARTI, type "IBM PC" (including the quotation marks) at the "Action" prompt of PARTI. The various branching subgroups of messages are numbered. Two active subgroups for the PC are 1508, which focuses on problems, languages, and programming; and 2998, which centers on user groups. To begin with the messages in either of these categories, type the number at the "Action" prompt.

Look Out Behind!

In the Good Uses of Computers department, Toyota has developed a combination microprocessor and sonar system that sends ultrasound waves from the rear of a car when backing up. The waves bounce off anything within 6½ feet of the rear bumper, and at 6 feet the cigar-box-size computer flashes lights and sounds a beeper to warn the driver. If the car continues to move backwards, the lights flash insistently and the beeping becomes constant, an effect meant to alert the driver to brake. This new warning device has not been exported from Japan, however, so for now American Toyota owners are on their own in reverse.



"He came close last year, but close only counts with skunks, horseshoes, and hand grenades."

—Miss Oklahoma, Nancy Chapman, commenting on a computer expert's failure to correctly predict Miss America of 1981
UPI

Free PC Software

At least 13 volumes of software from the two national CP/M user groups (CPMUG and SIG/M) are now available for the IBM PC. These organizations have long promoted sharing useful and innovative programs by offering them free through groups and bulletin boards. Most programs available for the PC are written in Microsoft BASIC and will require minor changes, such as added spaces between characters, to be compatible with the PC's version of BASIC and PC-DOS. This software, however, is all in the public domain and a group of users could divide up this modification task and share copies of the finished versions.

Distribution channels for the new batch of PC software have not been established, but information is available from the New York Amateur Computing Club, P.O. Box 106, Church Street Station, New York, NY 10008. Be sure to enclose a self-addressed, stamped envelope for reply. This nonprofit group provides a fine service by cataloging and distributing CP/M software; PCers are fortunate to tap such resources so easily.

Cave Games

Some of us at *PCommuniques* really enjoy cave games and other underground adventures. We were delighted when *Zork I* and *II* became available for the PC, but a reader notified us of a bug in *Zork I* and the simple fix for that problem. It seems that when *Zork* is run with a color/graphics card and a green phosphor or black and white monitor, it displays text that is virtually unreadable in the 80-column mode and barely readable in the 40-column mode. Infocom, the distributor of *Zork*, supplied this solution for the problem; the fix will also solve any similar problem with *Zork II* or the mystery game *Deadline*.

When you boot the game, listen for the system's beep. As soon as you hear it, type the digit 8. The booting will stop and the letter "U" will appear in the upper left corner of the screen. When you see the "U," type in 70 with no spaces and no carriage return. After typing 70 (the digits will appear on the screen next to the "U"), you will see the letter "N" on the lower left of the screen. Immediately type 07. Now you can play cave games, our anonymous reader says, "with text that looks like Sophia Loren."

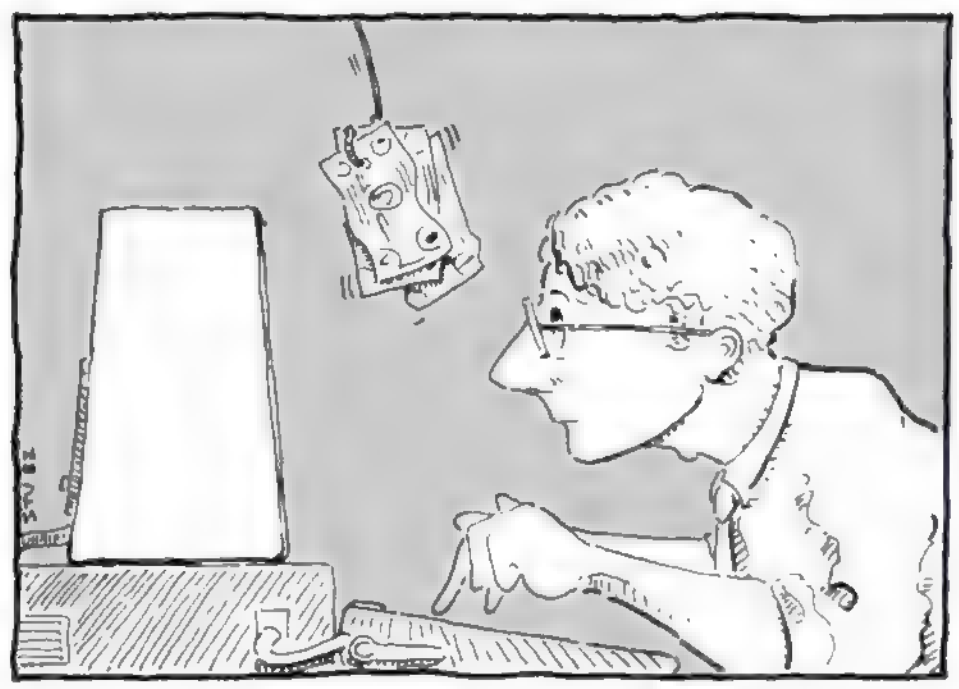
European Standards

If a Swiss firm has its way, future BASIC programmers will no longer concern themselves with many of the mundane tasks required to write business application programs. Automated Development Framework (ADF) was designed to provide programmers with a standard set of routines for such tasks as keyboard input, screen formatting, error handling, sorting and routing data.

ADF was created in Zurich by Computer Terminal AG as a tool to help develop business software for the European market. Computer Terminal AG hopes to set standards for European and, eventually, American PC BASIC programmers.

The firm's United States spokesperson, Michael Rohrbach, promises that ADF can be used by programmers with little knowledge of the PC or its operating system, making it easier for a company's data processing department to adapt programs for the PC.

The system provides faster coding and greater consistency from one program to another and assures that the product of one ADF programmer will be compatible with those of others using the methodology. It also makes life easier for the end user since all ADF programs share a similar command structure. The methodology makes it easy for programmers to create on-screen menus that guide the end user from one task to another.



Trading Pens for PCs

Writer's Digest is a magazine pored over by aspiring writers searching for tips on how to get work published. Since the supply of writers wanting to be published is customarily larger than that of interested publishers, a prominent category of advertisers in *Writer's Digest* is the so-called "vanity press." For a fee these presses offer to publish the works of those who find other opportunities elusive.

Authors of personal computer programs certainly have a different experience. Apparently theirs is still very much a seller's market. Two successive pages of *Computer Update*, a publication of the Boston Computer Society, include aggressive ads from software publishers seeking submissions. "Advanced royalties," screams the headline of Alpha Software Corporation, "We pay up to ten times more than IBM."

"We're turning programs into products," says Dolphin Software Corporation in equally large letters on the previous page. "We make sure royalties keep rolling in," Dolphin promises, urging writers to "Call us today."

If the *Writer's Digest* crowd ever gets wind of this, a lot of people may be trading in their pens for PCs.

P-Communiques

Hard Disks Proliferate

During recent months a number of independent hardware manufacturers and vendors have offered Winchester-style hard disk drives for the PC. Some of these drives are designed to fit into the PC cabinet in place of a conventional disk drive, and others are supplied in a separate cabinet or an expansion chassis. Now IBM has gotten into the act by asking makers of 5¼-inch Winchesters to submit direct bids to Big Blue to become suppliers of the hard disks. How many of these disks does IBM plan to buy? Oh, about 100,000.

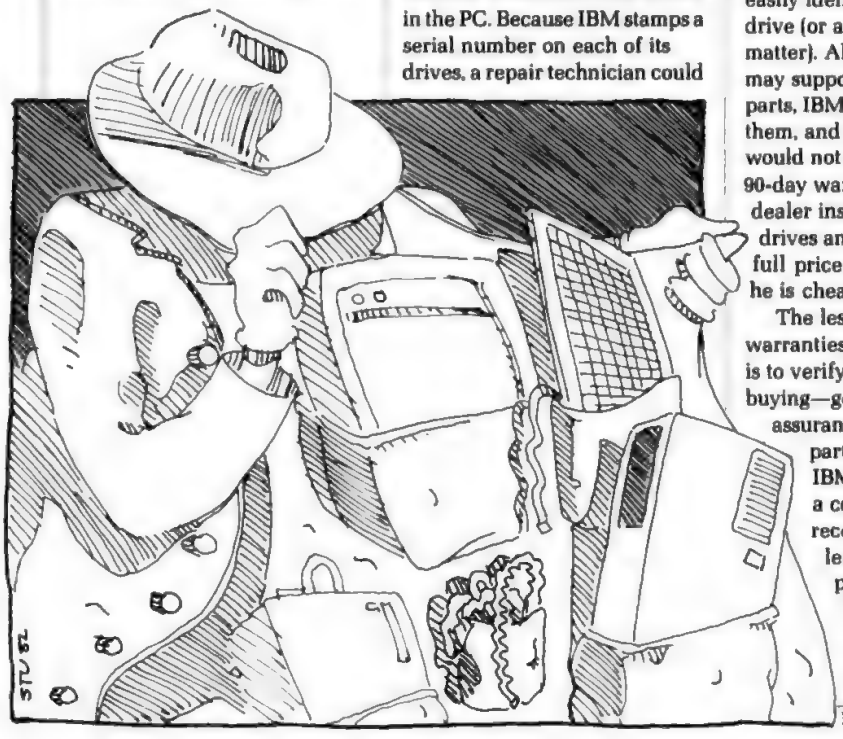
Buyer Beware

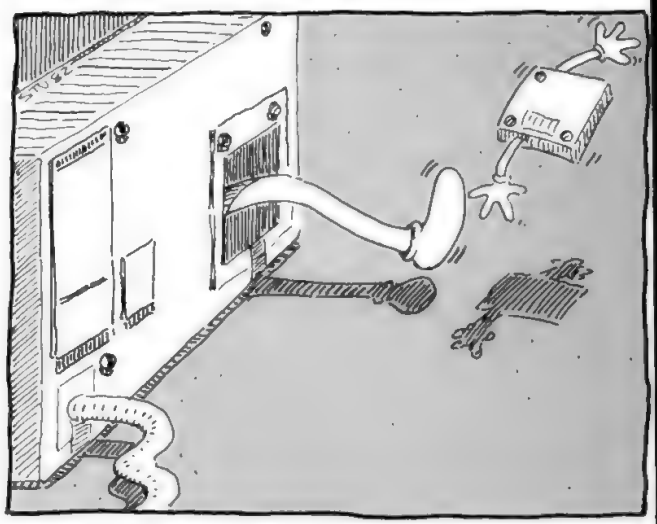
Several concerned owners and prospective buyers have reported that some retailers who advertise and sell the PC are not authorized IBM dealers. These firms buy PCs from an authorized dealer (receiving a discount for quantity purchasing) and resell the computers at a retail price. In many instances unauthorized dealers offer some kind of discount to the consumer, but these initial savings might not be worthwhile in the end.

IBM's warranty policy covers the PC for 90 days from the date of purchase. The unauthorized dealer, in this case, is the original purchaser and the 90 days begins on his or her date of purchase. So if you come along a week or a month later and buy the PC from that dealer, you will have the remainder of the original 90 days as your actual warranty period.

The original configuration of the system is the buyer's second concern. Some users are charging that a small group of dealers, including authorized ones, are installing compatible, but non-IBM-coded disk drives in the PC. Because IBM stamps a serial number on each of its drives, a repair technician could easily identify any non-IBM drive (or any other part for that matter). Although the dealer may support such non-IBM parts, IBM itself will not service them, and that non-IBM drive would not be covered by IBM's 90-day warranty. Also, if a dealer installs non-IBM-coded drives and sells them at the full price of IBM equipment, he is cheating his customers.

The lesson in this thicket of warranties and serial numbers is to verify what you are buying—get the dealer's assurance in writing that the parts are indeed from IBM, and establish from a copy of the dealer's receipt the precise length of your warranty period if you buy a PC from anyone other than an authorized dealer.





Den of Iniquity

IBM plans to eliminate a punchout on the rear of the PC chassis that could spell trouble for some multifunction expansion boards. The punchout, labeled "Cable Opening for RF Modulator" in the *Guide to Operations*, happens to be just the right size for a printer connector, and is used to mount those connectors by a few enterprising board designers. Word is that vendor uproar has caused Big Blue to reconsider the move, but only time will tell.

P-Communique Pays

Do you have news, gossip, or unusual computer tales for *P-Communiques*? We will pay up to $50 for each submission used. You must include your name, address, and telephone number with the item. We will preserve your anonymity if you wish. All submissions become the property of *PC* and are subject to editing. Our *User-to-User* section also publishes and pays for readers' submissions; this section features tips, problem solutions, and short programs or routines. Please address submissions to the appropriate department—*P-Communiques* or *User-to-User*—at *PC* magazine, 1528 Irving St., San Francisco, CA 94122.

Interested in the IBM Personal Computer?

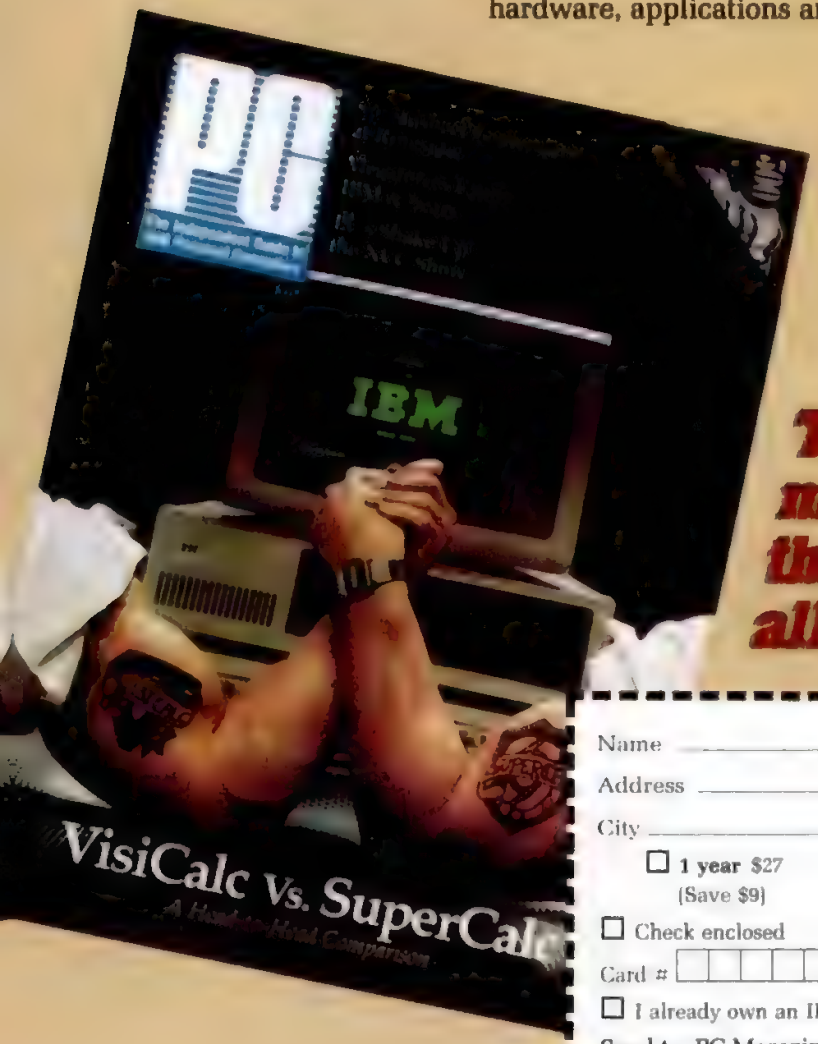
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IBM PC* requirements: 64K RAM, disk drive, PC DOS; 80-character display. Color and monochrome versions supplied with each package.

APPLE II requirements:** (DOS 3.3) 48K RAM, disk drive, 40-character display.

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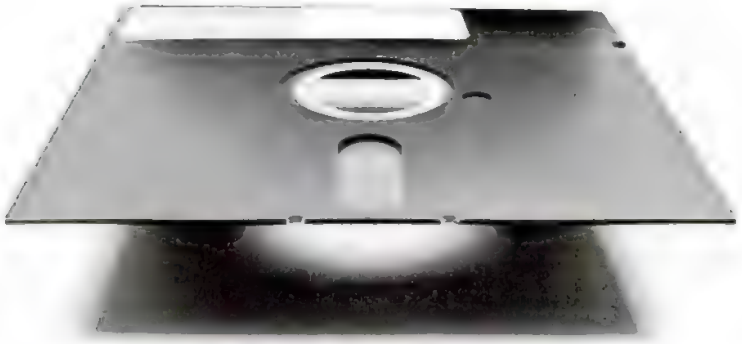
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PC Tutor

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Data on DOS

Q: When I purchased my PC several months ago, I read the books that came with the computer, including the DOS manual. I felt that even as a novice I had a fairly good understanding of DOS. However, as I read material from other manuals and articles referring to DOS, I became more and more confused. Do you have a simple explanation of DOS? What is it, what does it do, and why do I need it in my PC?

Dr. Marvin Rosen, DDS
San Bernardino, California

A: *I can understand why you may be a little hazy about DOS. IBM is not the only guilty party when it comes to using the acronym DOS (disk operating system) in different contexts while meaning different things. When you first open the beige binder with the white letters "DOS," you get the impression that DOS is, in fact, all the things that are documented within that binder and contained on the DOS disk. In the strictest sense, that is not true. The DOS diskette has three main parts: the disk operating system, DOS utilities, and sample BASIC programs.*

The disk operating system, or "system," is made up of three programs: IBMBIO.COM, IBMDOS.COM, and COMMAND.COM. The first two programs are in hidden files on the DOS diskette and cannot be seen on the directory. Other programs on the DOS diskette ending with the file name extension of either COM or EXE make up the utility portion of DOS. Many applications programs do not require these utilities, but do require having the disk operating system on the program diskette.

To understand what the DOS does, let's use the automobile analogy. The operator of an automobile does not need to know all the details of the internal combustion engine to be able to get into a car and drive to the grocery store. All the driver needs to know is how to turn on the motor, step on the gas, and go.

IBM IS NOT the only guilty party when it comes to using the acronym DOS to mean several different things.

The same is true with applications programs such as spreadsheets or word processors. The applications programs do not need to know the innermost workings of the disk drives, such as how the data is stored on the diskette, to be able to use them to store and retrieve data. Just as the shift lever translates your intention to speed up into an elaborate series of mechanical events, so the DOS mediates between the applications program and the computer.

A car owner does need certain tools to be able to operate the vehicle: keys to open the doors and start the motor, a rag to wipe the windows when covered with dew, and a tire iron and jack to change a flat tire. DOS utility programs such as DISKCOPY.COM and FORMAT.COM are necessary tools for a complete and functional disk system; they would not be needed if we did not have diskette drives.

Some confusion is created by the two different levels on which DOS operates. At one level DOS functions work interactively with applications programs. At the other level DOS may be accessed at the A> prompt by entering the appropriate commands. DOS functions are described in Appendix B of the DOS manual, while DOS commands are described in Chapter 3. EDLIN, LINK, and DEBUG are other DOS utility programs stored on the original DOS diskette.

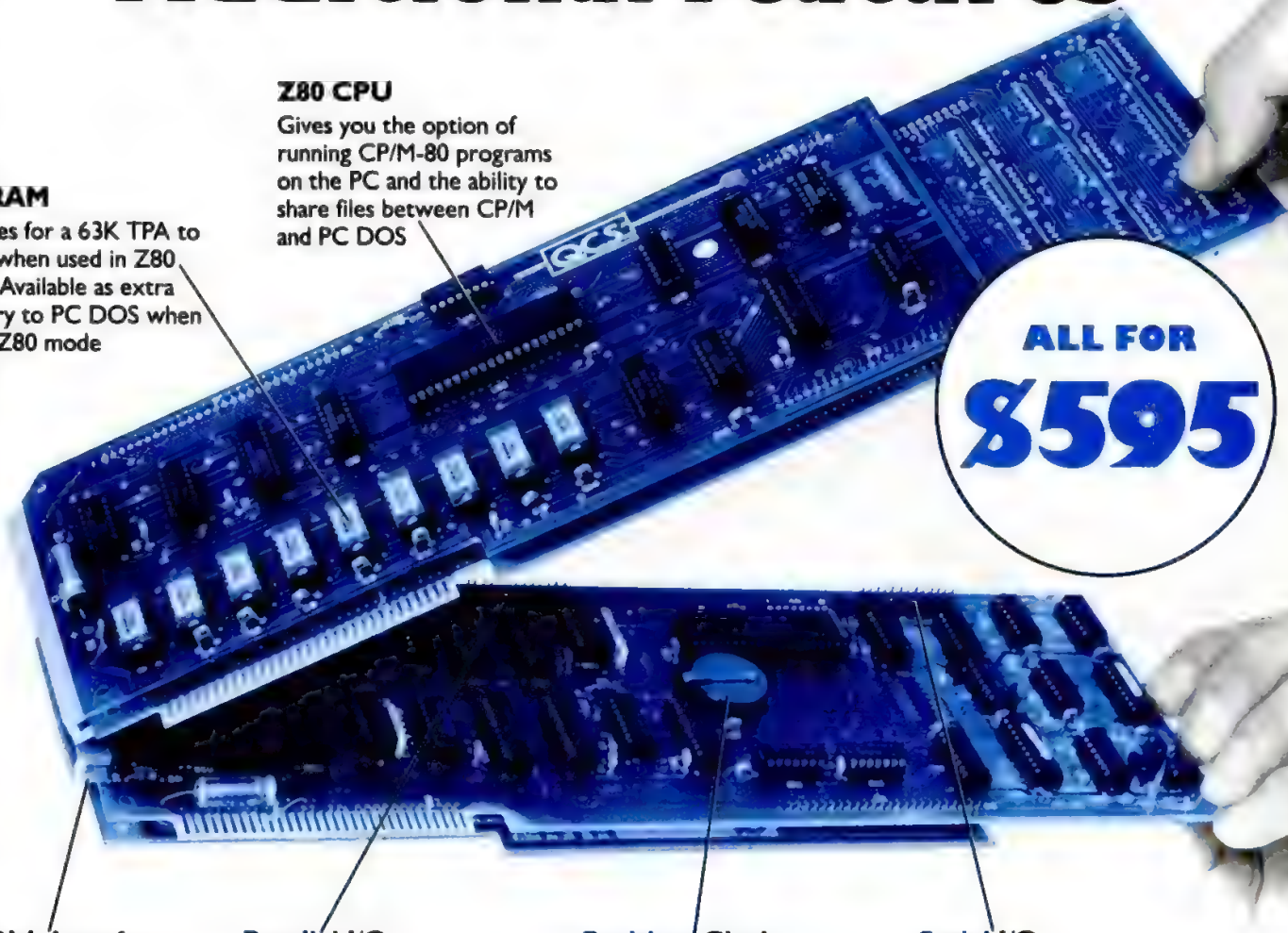
The term "DOS diskette" is also used in different contexts. This term may refer to a DOS diskette as supplied by IBM, which includes the operating system, utilities, and sample programs; it may be an applications program diskette containing the system programs (IBMBIO.COM, IBMDOS.COM, and COMMAND.COM); or simply a formatted diskette. The context in which "DOS diskette" is used may help you determine what the author means by the term. "Back up the DOS diskette and use the copy as a work diskette" probably refers to the original DOS diskette provided by IBM with the DOS manual. "Insert a DOS diskette and strike any key when ready" would probably refer to any diskette with the system on it.

I hope I have cleared up some confusion about DOS and provided insight into its role in the workings of the PC.

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Lapse of Memory

Q: I recently purchased a memory combination board, giving a total of 128K of memory in my PC. When I load BASICA, it shows that I have only 61,103 bytes free. How can I determine if all of the memory is working?

Jim Serbin
Phoenix, Arizona

A: You are actually asking two questions. "Why does BASIC show only 61,103 bytes free?" and "How can I test all the memory in my PC?"

To answer your first question, BASIC is limited to a total user work space of 64K. Before you purchased the expansion board with 64K, you had a total of 64K of memory installed in the system unit. With that amount of memory, when you load the DOS, which uses approximately 12K of memory, and BASICA, which uses approximately 18.5K of memory, you have approximately 34K of user work space available in a 64K system. When you install an additional 64K of memory, you may expect the number of total bytes free to increase to 98K. Unfortunately, this is not the case because of BASIC's 64K work space limitation.

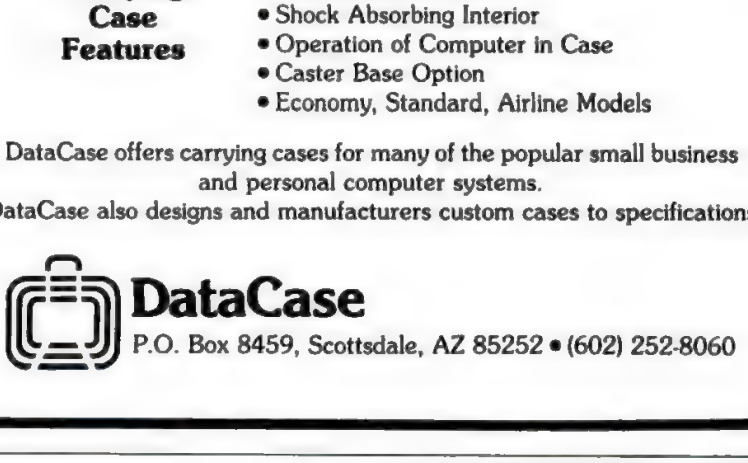
At this point you may be asking yourself why you purchased an additional 64K of memory instead of 32K. This limitation applies to BASIC only, and assembly language subroutines that interface with BASIC can be stored in memory outside of BASIC's 64K work space.

To answer your second question about how to ensure that your additional memory is functioning properly, I would recommend utilizing the Diagnostic diskette provided in the Guide to Operations (the maroon binder supplied with the PC). When installing accessories, including memory, it may be necessary to change switch settings located on the system board. The Diagnostic program will report to you the installed options and the amount of memory that has been set. If this amount is incorrect, change the switch settings to reflect the proper amount of installed memory. Running the Diagnostic program is an adequate way to check newly installed IBM-compatible devices. It should be run any time an equipment problem is suspected. If an installed device is not compatible with an existing IBM product, consult the manufacturer for proper checkout procedures.

Once the Diagnostic program has been run, and in the case of memory, the correct amount of memory has been set with the system switches, then each time the system is turned on, a self-test will check the installed memory. If an error occurs

DOS UTILITY programs such as DISKCOPY.COM and FORMAT.COM are necessary tools for a complete and functional disk system.

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during the self-test, an error code will be displayed in the upper left corner of the screen. The error code numbers are assigned according to the part of the system that is failing. The following is a list of device numbers assigned by IBM:

CODE	COMPONENT
100	System unit (CPU)
200	Memory
300	Keyboard
400	Monochrome display and adapter
500	Color display and adapter
600	Diskette drives
900	Parallel printer adapter
1100	Asynchronous communications adapter
1300	Game control adapter
1400	IBM printer

The device code may be preceded by a failing unit code. In the case of memory, these error codes may even allow you to determine the exact memory chip that has failed. The Hardware Maintenance and Service Manual, also known as the Advanced Diagnostics Package, gives specific information about these error codes.

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Q: I purchased a Sony RGB monitor, the Profeel KX-1901, but I am unable to connect the monitor properly using the RGB inputs. Can you tell me how to make it work?

Gerald E. Siefken
New Orleans, Louisiana

A: You're in the same predicament I was in. After investing over $700 in the Sony monitor, I was unable to use the RGB interface with the IBM color/graphics adapter, and neither Sony nor IBM could explain why. I researched the problem myself and determined that the color/graphics adapter produces positive-polarity horizontal and vertical sync signals, while the Profeel monitor is designed to accept negative polarity signals.

My solution was to modify the color/graphics adapter to provide negative polarity sync signals. The junction of R5 and pin 18 of IC U24 on the color/graphics adapter provides a negative polarity sync, so I routed this signal to the correct pin of the RGB connector. Be aware that this modification will void the warranty on the color/graphics adapter. If you do not feel comfortable modifying the color/graphics adapter, consult PC Directory for companies that provide this service.

A BASIC Alternative to Starting Over

Q: When in BASIC, how do I prevent the "? Redo from start" message that appears as a result of an error made during an INPUT statement?

Jim Faryar
Los Angeles, California

A: In BASIC certain powerful statements provide for "error trapping." The ON ERROR statement can be placed at any point in the BASIC program where error trapping is desired. It may be placed at the beginning of the program or just before the INPUT statement that is giving you the problem. The ON ERROR GOTO statement allows you to write your own subrou-

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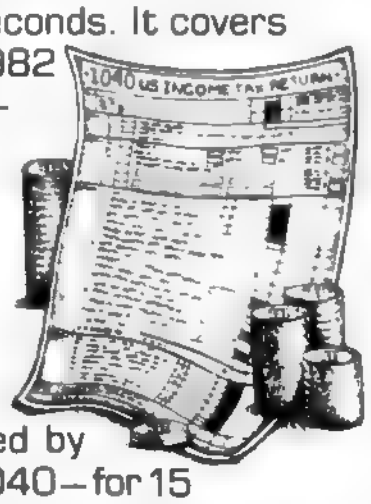
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tine to handle the error.

Error handling subroutines can check the type of error by using the ERR variable to determine the error number. Error numbers are listed in Appendix A of the BASIC manual.

The line that was executing when the error occurred can be determined using the ERL variable. Error handling subroutines must terminate with the RESUME statement. Error trapping can be cancelled at any time during the program by including the ON ERROR GOTO 0 statement, which will allow normal error processing in BASIC.

WordStar: A Friend at the Office

Q: We are using *WordStar* at the office. Many of our secretaries are not familiar with the computer or word processing. Can you suggest a simple procedure for getting the diskettes in the correct drives and the program started?

Janet Brownlee
Van Nuys, California

A: *The power of DOS is at your fingertips. With a few simple commands, you can make some important improvements in the user-friendliness of* WordStar. *Instead of having to type* WS *to start the program, create an "autoexecution" batch file on the* WordStar *diskette by following the instructions below. (This example is good for only dual diskette drive systems.)*

- *Insert your* WordStar *program diskette into drive A: and a copy of the DOS diskette into drive B:.*
- *Depress [Ctrl]-[Alt]-[Del] to restart the system.*
- *After entering the date, enter* copy b:chkdsk.com *at the DOS command prompt A> and depress [Enter]. Next, type* copy b:date.com, *and depress [Enter]. (This step is applicable to DOS 1.0 only.) At this time you may also want to copy over other DOS utilities such as FORMAT.COM. (FORMAT, CHKDSK, etc., may be run from* WordStar's *"No File" menu using the R(un) program feature.)*
- *Type* A>copy con:autoexec.bat *[Enter]. Everything you type in after this last [Enter] will be stored in the AUTOEXEC.BAT file. For this example, type the following commands.*

```
date  [Enter]
pause  ==Insert Data diskette into
  drive B: [Enter]
dir b:  [Enter]
pause  [Enter]
chkdsk b:  [Enter]
pause  ==Insure sufficient room on
  Data diskette [Enter]
b:  [Enter]
a:ws  [Enter]
a:  [Enter]
```

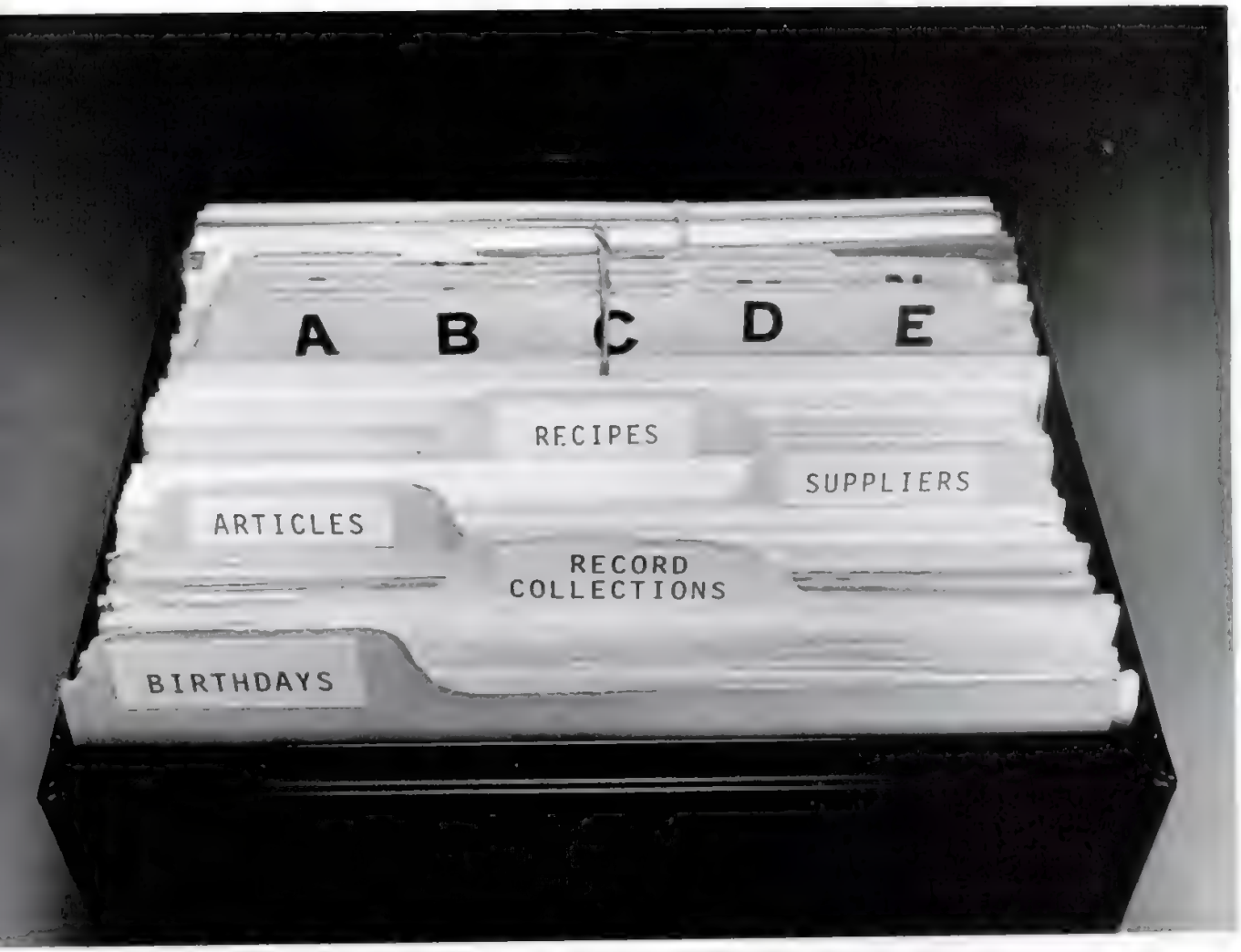
- *Finally, depress function key 6 and then [Enter].*

By creating an AUTOEXEC.BAT file, whenever the WordStar *program diskette is loaded, the DOS commands entered in that file will execute automatically. The DATE command prompts you to input the correct date. This is important, since all DOS files are date stamped when the date is available. (When using DOS 1.10, you might also want to add the TIME command, since DOS 1.10 also puts the time on the directory when available.) The PAUSE command displays a remark prompting the user to insert the data diskette into the B drive; after a pause, it prompts "Depress any key when ready" to show that the PC is ready to continue whenever you are.*

BASIC IS limited to a total user work space of 64K.

The AUTOEXEC.BAT file also causes a directory of the diskette in Drive B to be displayed. This is helpful in determining whether the data diskette contains the file you want. The directory also provides the number of bytes used by each file. The PAUSE command at this point prevents further scrolling of the screen while you read the directory. With DOS 1.10, use the dir b:/p *command to pause for each screenful of the directory. Next, the CHKDSK command shows how much room is left on the data diskette for additional material.*

The next PAUSE command allows you to read the available space figures before proceeding to the WordStar *pro-*



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gram. Remember that a backup file will be created for each file you edit. Double the required disk space for files before making an evaluation of available space.

The B: command changes the default drive in DOS before proceeding to run the WordStar program, thus eliminating the necessity of changing the "Logged Disk Drive." Next the WS (WordStar program) is called from the A: drive,

RUNNING THE *Diagnostic program is an adequate way to check newly installed IBM-compatible devices.*

since the default has been changed to B:. Last but not least, if you utilize the X (exit function) of WordStar to terminate the program, the default drive will be returned to A> by the last A: command in the AUTOEXEC.BAT file.

You may want to add other helpful items to your AUTOEXEC.BAT file. My own contains a call to a BASIC program that sets the dot matrix printer to letter quality mode and turns off the automatic page skip feature. This procedure requires having BASIC or BASICA.COM on the WordStar diskette. The BASIC program must end with a SYSTEM command to return control to the DOS AUTOEXEC.BAT file. If you are using DOS 1.0, you may want to include the SPEEDUP.COM program as the first entry in the batch file.

I'd like to thank Dr. Burton Alperson of California State University, Los Angeles, for his input. **/PC**

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MP/M-86	Yes	—	?
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For comparison purposes, typical professional configurations consist of 16-Bit 8088 Processor, 128K RAM with Parity, Dual 320K 5-inch Floppies, DMA and Interrupt Controller, Dual RS-232 Serial Ports, Centronics Parallel Port and Dumb Computer Terminal or Equivalent.

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A PC REVISES THE BIBLE

St. Stephen and the Incarnation Church of Washington, D.C. canonizes the PC. Father Woodard and members of his congregation intend to use the computer for a number of functions.

Widely known for its ministries among disadvantaged people, Saint Stephen and the Incarnation Church in Washington, D.C., is located in the area of the 1968 riots. Its congregation consists of blacks and whites, neighborhood residents and out-of-towners, the affluent and the poor. Social programs include a free clinic, a children's center, and a food project that serves 60,000 meals a year to hungry people in the neighborhood and more than 200,000 meals in soup kitchens elsewhere in D.C. St. Stephen's offers a walk-in ministry program for people in crisis. It is frequently a hostel for demonstrators who come to Washington to campaign for social causes and world peace. It was one of the first Episcopal parishes to ordain women as priests.

Following is an interview with Father Jack Woodard and Parish Treasurer Pat Wenner. Jack Woodard is a father in more than one sense. PC's Associate Publisher Cheryl Woodard, who conducted this interview, is one of his three daughters.

PC: Why did you decide to buy an IBM Personal Computer?

Woodard: Because you told me about all the things a PC could help us do, such as produce our newsletter, keep books, and maintain mailing lists. I happened to recount the conversation to a wealthy man I know, and the following Monday he offered us the money to buy the computer. That's the whole story.

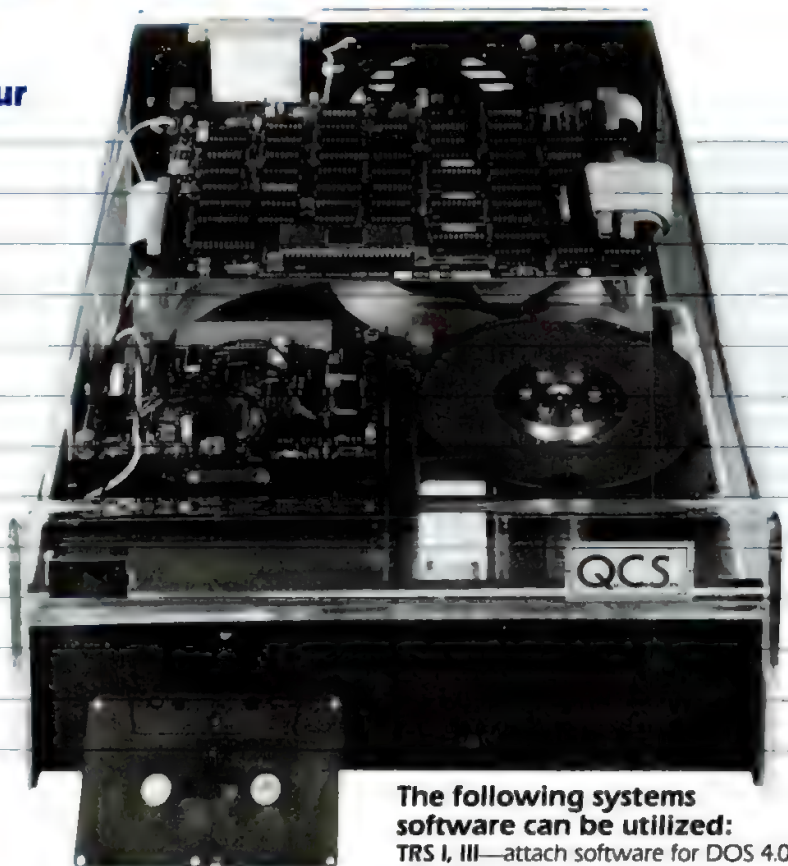
PC: That sounds easy. Who was St. Stephen's benefactor?

Woodard: Our donor wants to remain anonymous, but I can tell you a little bit about him. He owns a big accounting firm and was one of the first—if not the first—to computerize income tax preparation.

Photograph: Jacqueline Poitier Hand Tinting: Alice Lager

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Come tax time, his firm punches out income tax returns, vastly increasing the number of clients it can handle, and they can take advantage of every break in the tax laws. He's a serious churchman and he gave a personal computer to St. Stephen's because he was curious to see what a computer could do in an inner city church.

PC: I'm interested in how you assembled the computer system you needed. Pat, you were given a large share of this responsibility, but have you had any experience with microcomputers?

Wenner: Not with microcomputers, but I've had experience with mainframes such as IBM and Datavac. I'm currently working on a Ph.D. in Computer Science at George Washington University. I took a computer course last semester for which we had to do papers on microprocessor architecture. I chose to study the IBM PC. I really got into 8088/8086 architecture so I could understand what is going on in there. I acquired one of the first technical reference manuals (the *IBM Personal Computer Technical Reference Manual*), and it was very helpful.

PC: After you decided to buy a personal computer, how did you decide which components to buy?

Wenner: Jack had a definite preference for the IBM, but I wasn't convinced. I looked at Apples and Radio Shack computers, but I wanted to stay with a main line company. I was concerned about maintenance and support, so I got the IBM and I'm really pleased with it. We had slightly less money than we needed, but we got some support from the congregation. The only thing that could sting us is needing more memory. We decided not to go with a lot of memory at the beginning, and that's going to mean more money later on.

Woodard: I have found that raising money for this computer has been easy. Even the man who gave us the major part of the investment gave us more later on. The total budget so far has been about $8,300 including the software we will want to buy as it becomes available.

Wenner: Eventually, we'll be putting in a Winchester disk, but we didn't want to put that in the budget right now. That purchase would have put us over $10,000. We decided to wait. I understand that prices of some components for the personal computer are coming down anyway.

PC: Tell us more about editing the Bible.

Woodard: First, you really have to understand what a lectionary is. A few years ago the Roman Catholic Church, the Episcopal Church, the Lutheran Church, and the Presbyterian Church all agreed to read the same portions of the Bible in their services each Sunday—the same readings from the Old Testament, the Epistles, and the Gospels. These readings come from the lectionary. Thousands of local churches are involved. Over the course of a 3-year cycle, all those congregations are exposed to almost the entire Bible.

SOME PEOPLE feel strongly about letting the computer anywhere near church property.

The New vs. the Old: Two Versions of Genesis 11:1-9

St. Stephen's Revised Version

Once upon a time the whole world had one language and a common vocabulary. As people moved eastward, they found a plain in the land of Shinar and settled there. They said to one another, "Come, let us make bricks and bake them hard." They used bricks rather than stone and tar instead of mortar. Then they said, "Come, let us build ourselves a city with a tower that reaches heaven. And let us make a name for ourselves so that we may not be scattered about the whole earth."

The Lord came down to see the city and the tower, which humans were building. "Look at what they have begun," the Lord said, "working as a united people with a single language. So nothing they have a mind to do will be beyond their reach. Come, let us go down there and confuse their language so that they may not understand one another's speech."

So the Lord scattered them from there all over the earth, and they stopped building the city. That is why it is called "Babel," because the Lord made a babble of the language of all the world. And from that place the Lord scattered the people all over the face of the earth.

Revised Standard Version

Now the whole earth had one language and few words.[2] And as men migrated in the east, they found a plain in the land of Shinar and settled there. [3]And they said to one another, "Come, let us make bricks, and burn them thoroughly." And they had brick for stone, and bitumen for mortar. [4]Then they said, "Come, let us build ourselves a city, and a tower with its top in the heavens, and let us make a name for ourselves, lest we be scattered abroad upon the face of the whole earth." [5]And the Lord came down to see the city and the tower, which the sons of men had built. [6]And the Lord said, "Behold, they are one people, and they have all one language; and this is only the beginning of what they will do; and nothing that they propose to do will now be impossible for them. [7]Come, let us go down, and there confuse their language, that they may not understand one another's speech." [8]So the Lord scattered them abroad from there over the face of all the earth, and they left off building the city. [9]Therefore its name was called Babel, because there the Lord confused the language of all the earth; and from there the Lord scattered them abroad over the face of all the earth.

PC: Why revise the lectionary?

Woodard: Word forms are primarily important to us. If a girl is brought up hearing nothing but male images of God, her affinity with God, her ability to find a way into a construct that is personal for her, is in jeopardy. That's grossly unfair and grossly inaccurate. God has no gender.

We at St. Stephen's have tried to get beyond human imagery for God. In Michelangelo's Sistine Chapel God is an old man with a beard sitting on a pillow in the sky. Many people are stuck with that image of God, and it is inadequate. We're working to eliminate the sexist language in the lectionary because gender is obviously human imagery. We're trying to move people's concepts of God to a more sophisticated level. Some people want equal time on the God question, using "she" as a pronoun for God as much as "he," and people like myself want God called neither he nor she, but "Source," "Transcendant One," "Creator," "Redeemer," "Sanctifier," or "Savior." We want to help people get beyond the image of the old man on the ceiling in the Sistine Chapel. We're up to some pretty primordial stuff in changing this language.

PC: I would think so. How do you decide on language changes?

IT'S AN audacious task for one church in one city to undertake.

Woodard: The committee comprises quite a few people, both men and women. One man is particularly valuable because he's done graduate work in theology and languages. He knows Greek. One of the women is a professor of mathematics at Howard University. Another has a theological education. Her husband is a priest and she has two babies. It really takes a large time commitment for her to work with the committee, but she's the leader of the project. They are highly educated people with writing and editing skills. The committee chairperson was a magazine editor.

PC: Is it a nondenominational committee?

Wenner: Not really. The members are from our congregation.

Woodard: We're not trying to publish some great hit of the publishing trade. The fundamental thing we agreed to and that the committee has held to is that this lectionary is the work of this congregation. What makes that interesting is that this is probably the most diverse congregation in the Episcopal Church. When it all comes together, we'll have something that has got a very broad base in terms of point of view and understanding of language. The work is being done by the people of this parish for the people of this parish, but it will be relevant to other people as well.

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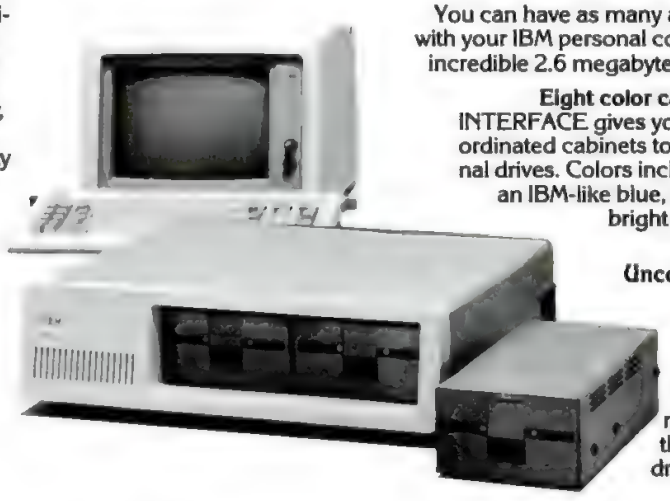
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WE WANT TO make the lectionary available on floppy disks.

the task and they are not taking it lightly. Changing a single word can take hours. What emerges comes from the wrestling of dedicated Christians who respect the Bible and are familiar with male/female communications, but who are trying to get to a new place, to get beyond the older imagery, and to make new and adequate concepts. It's an audacious task for one church in one city to undertake.

PC: Tell me more about the changes you will make to the standard King James version of the Bible. You've eliminated the human images of God, but how?

Woodard: A lectionary is designed to be read aloud. Many of the changes we're making have to do with the difference between language that is read and language that is spoken. People don't realize the difference between the two. We're rearranging the way the words appear in sentences to make them more intelligible to people who hear them.

Here's an example. Originally it read: "Phillip said to Jesus, 'Lord show us the Father and that will be enough for us.' 'Have I been with you all this time, Phillip, and still you do not know me?' " Jesus answered.

If you are reading this passage by yourself, you know where the quotation marks are; you know when Jesus is speaking to Phillip. We changed it to read: "Phillip said to Jesus, 'Lord, show us your Father and that will be enough for us.' Jesus answered, 'Have I been with you all this time, Phillip, and still you do not know me?' "

We also changed the way they refer to Jesus' father in that passage. In the original, God is called "The Father." We've changed "the father" to "your father." The incarnate Jesus had no other father than God, so for him to talk about "my father" and for someone else to say to Jesus, "I want to know more about your father," is all very natural. It's a legitimate question. Not sexist at all. In other places in the Bible, unless it's talking about the father of Jesus Christ, we've changed the word "Father" to something else, such as "Creator," "Originator," or "Source." That's an example of the changes we've made for the sake of image.

We're trying to help inexperienced lay readers interpret the language correctly for the rest of the congregation. Our version is full of changes that have an astounding effect on understanding when you listen in church. Suddenly the text comes alive. With sexism gone, both women and men find they can identify personally with God.

PC: Do you have plans for distributing the lectionary beyond the Episcopal church?

Woodard. Sure. We will be testing the reaction to this project. The lectionary is divided into three cycles, but we're publishing one—the one for next year. If we can recover the capital we've been given so far, we will go on with the other two.

PC: Why did you decide to use a personal computer instead of professional typesetting?

Wenner: We need the computer here in the church. We're spending a lot of time on ledger books; we put out a weekly newsletter that goes to about 1,300 addresses; and Jack sends out a lot of letters. I wish we had a color monitor for finances—something that would show all the red. We have many accounts. St. Stephen's has seven corporations. All the community groups and projects that function here are treated as separate projects. We feed hundreds of poor people every week, but that works separately from the church's budget.

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Woodard: I don't know what we'd do without Pat to work out all these problems. She has the clearest idea of the essential usefulness of this computer. She can envision

WE'RE working to eliminate sexist language in the lectionary.

what we'll be doing with it in a year or two in a way nobody else can.

Wenner: We also bought the PC because we wanted to tie into other computers. We have the asynchronous board to do just that. We can share mailing lists, for example. All our finances will eventually go onto the computer; we spend hours posting books by hand. We want to make the lectionary available on floppy disks.

PC: Do other churches have computers?

Woodard: I think many churches are going in for computers. In the Diocese of Washington D.C. they are actually encouraging parishes to buy computers. There's already a data base on all the parishes that will be kept up each year. Spreadsheets will be given to each parish every year to show trends in areas such as energy costs and salaries. Salaries will be compared to those of the other churches in the diocese. Discrepancies will show up.

I worry about how all those churches will be setting up their computer systems. I know that churches want computers, but they are all concerned about how they will ever actually operate them.

Wenner: Most of them probably have computer programmers in their congregations. All they have to do is find them.

Woodard: That's probably true, but getting started can often be very expensive. Computer salespeople tell innocent customers, "Oh sure, buy a computer. Just send one of

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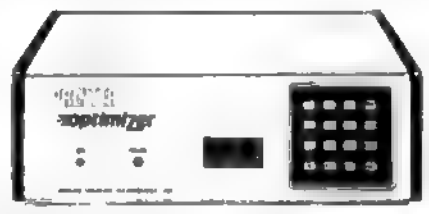
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your people down here to our store for a few hours of training and you'll be all set." That's just not true.

Wenner: But we're trying to put the most menial tasks on the computer to give us more time to work with people.

Woodard: Right. Get rid of the file cards and papers so that the people who come in here in real crisis can get helped.

SOME THOUGHT the computer would be a dehumanizing influence.

PC: Do people in your church consider computers dangerous?

Woodard: There was some really strong feeling against letting the computer anywhere near church property. People feared that a computer would replace people's jobs and dehumanize our work. While I agree with you that computers are not necessarily bad in and of themselves, I caution you to avoid downplaying the danger of the computers that are in the hands of forces trying to oppress and control people. Just last night I heard that the Reagan administration is using social security numbers to identify and track down the 800,000 young people who have not registered for the draft. The social security system was not set up to prosecute people; in fact, using social security numbers for that purpose is against the law. That's kind of scary. All my life I've been assured that my social security number was given to me for my own good—that it was protection against poverty in retirement. Now the government finds me through my social security number. There it was on the television—sheets on people who hadn't registered being flipped out of the social security computers. And the computer makes this possible. Who would want to sort through 800,000 file cards?

PC: Should you get angry at the computer or at the people who have access to it?

Woodard: Of course we should look to Congress for this sort of thing. They have legislation about social security numbers



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being protected, and they should be challenging those who are misusing them. It's too bad, though, that progressives in this country have not been using computers the way conservatives have. If all our mailing lists were combined, for example, we could influence legislators. A network could evolve that would counteract the Falwells and the so-called Moral Majority. But we'd have to overcome abhorrence of technology.

I think Falwell is onto something. He really knows how to influence Congress. Whether or not we agree with what he's influencing Congress to do, we have to admit those conservative organizations really know how to do it. They use computer technology to design a mailing list to get hometown folks to write letters. They tell their Congressmen, "Listen, you better not vote for so and so or I'm not going to vote for you." Those kinds of tactics really work, but whether our plans actually come to pass or not remains to be seen.

Woodard: I realize that if this church didn't have somebody like Pat, somebody as committed as she is, I don't know what we would do. Getting the computer to be really useful to us would be more difficult and more expensive.

PC: Are the people on your committee learning to use the computer as part of their project?

Wenner: No. They don't have time. The people who are working on the lectionary are also very involved in service projects here at the church. They don't sit around discussing language all day. These people are involved in many other projects. The church has a lot of service projects run by a small number of people, so people spread themselves around.

PC: Still, computers and the Bible is such an intriguing combination. I grew up with the King James version of the Bible, and relating that book to the IBM Personal Computer is very difficult for me.

Woodard: The King James version is what the whole world grew up on and was satisfied with until people realized they should be able to understand the Bible. **/PC**

If you are interested in contacting Father Woodard at St. Stephen and the Incarnation Church, write to P.O. Box 43202, 16th and Newton NW, Washington, DC 20010.

"It'll never fly, Orville."

History is rich in confident pronouncements gone wrong. Columbus was warned he'd sail off the end of the earth. The president of Western Union turned down the chance to buy Bell's patent on the telephone for $100,000, dismissing it as a mere electrical toy. And then there was the computer industry observer who commented in print some while ago that making IBM successful in the personal computer business, "would be like teaching an elephant to tap dance."

Wherever you see a tap dancing elephant in these pages, you'll discover new ways to make your programming easier and increase the flexibility of your IBM PC.

That elephant, as we have seen, was a quick study.

But in fact, the only thing that can make a computer dance is powerful software.

High-powered software—the kind that can make your PC get up and dance—is the focus of this special section. Quite a bit has emerged in the IBM Personal Computer's first year on the market. In the following pages, *PC* reports on several members of this growing collection. You'll read about operating systems and languages and be introduced to screen design, a program speed test, a screen editor, and a technique for accessing data files.

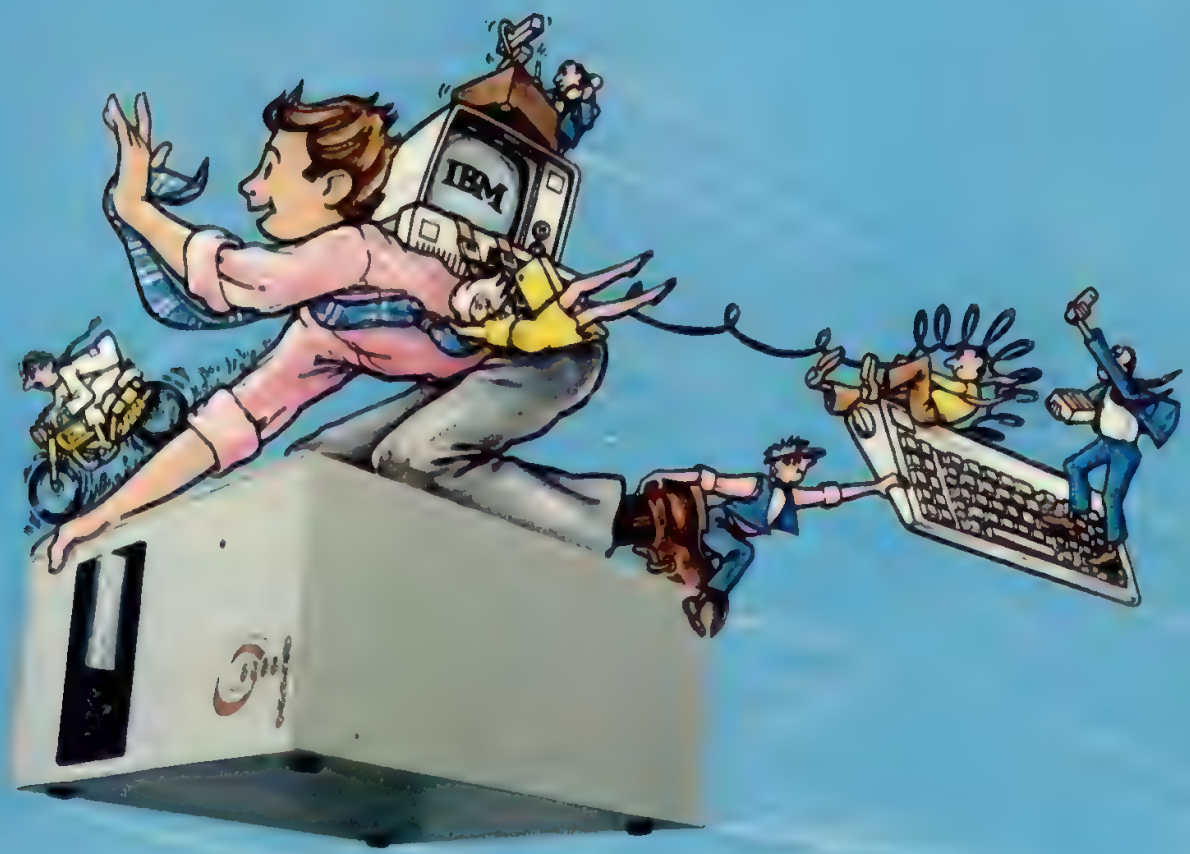


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IBM EYE/JIM EDLIN

Making The Elephant Tap Dance

Whatever your Personal Computer sales representative knows about PCs, chances are he or she learned it from Hal Jennings.



As a Marketing Support Representative for IBM's Systems Products Division in Boca Raton (the division that makes the PC), Hal Jennings' official responsibility is teaching the courses that authorize people to sell the PC. But over the last several months Jennings has volunteered himself for an additional task; he has become a principal author of the demonstration programs IBM provides dealers to help the PC sell itself.

Enroute to creating the demonstration programs, Jennings also created some powerful software tools. One steamy Florida afternoon (when even the air conditioning could barely preserve IBM's traditional blue-suited cool), Jennings took time out to show off his tool kit to a visitor from *PC* and to explain some of the techniques behind the tools.

"The dealers were packing 'em in," says Jennings, describing the necessity behind the development of his Graphics Character Generator (GCG) program. "There were layers of people viewing the demonstrations, and the regular-size characters on the screen just weren't readable for people behind the front rank."

Hal's solution was to create a program, the GCG, that uses the medium-resolution graphics mode of IBM's color/graphics adapter to create screens with large characters that have an almost typeset appearance. The GCG, written in BASIC, has three major subparts: one for designing video "type fonts," one to create "screens" using the fonts, and one to display screens after they are created.

Once a video type font is created with GCG, it is stored as a disk file. A font file may contain anything from a single character up to a full alphabet in two variations—about 200 characters. A font is created by designing one character at a time, so if you wanted to create a complete alphabet of 26 capital letters, 26 lowercase letters, ten numerals, and a helpful assortment of punctuation marks and symbols, you would have to go through the design process 80 or 90 times. If you wanted to design a second version of the font (say an italic variation of your original creation), you would have to repeat the process an-

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other 80 or 90 times. Hal Jennings has programmed shortcuts to make this somewhat less daunting than it sounds.

A Blank Grid

On the GCG program's initial menu the character design process is called "Define." When Jennings demonstrates this part of the tool, the screen clears and divides vertically into two work areas. The left area is a straightforward presentation of facts concerning the design in progress; the right area displays a blown up representation of the character being designed. Initially the right part is a blank grid, somewhat like graph paper, on which the character shape will be sketched.

The large characters of Jennings' type fonts, like characters displayed on computer screens in general, are made up of dots. It is the video equivalent of a dot matrix printer. Normal size characters on the PC's color/graphics display are arrangements of dots within a grid, or matrix, seven columns wide and nine rows high (on the monochrome display the grid is nine wide by 14 high); however, Jennings' program lets you set the grid size up to a maximum of 24 high by 24 wide. A separate grid height and width can be specified for each character designed, allowing the creation of proportionally spaced character sets while economizing on storage space for descriptions of characters that require less than the full grid. If a grid smaller than the maximum is chosen, matrix positions are eliminated from the bottom or right side while the upper left corner holds a constant position.

The first step in designing a character is selecting the code number (between 1 and 254) the computer will use internally to signify that character. If you were about to design a capital *A* for your new type font, for example, you might designate it as character number 65. (This choice would be practical because 65 is the number used to identify capital *A* in the PC's internal code for its standard character set, which is an expanded version of the widely used ASCII code. The program doesn't require that your numbering conform to the ASCII conventions, but it's generally more convenient to do so.) GCG will let you enter the code in either the decimal or hexadecimal numbering systems, and will then display the number in both systems, along with the standard PC character corresponding to the number. Type in &H42 and the display will show: "Decimal 66, Hex 42, B". At this stage you can also define both the horizontal and vertical sizes of the design grid within which you want your character to fit.

JENNINGS estimates he spent about 30 minutes designing each character.

Designing a Typeface

Once the preliminaries are done, a cursor appears in the right section of the screen. You can move the cursor to any dot in the grid, and then switch it from on to off or vice versa. A portion of the left-side display shows the evolving character's actual size as you create its greatly magnified version on the right. You can build up a character shape in this sample fashion, dot by dot. Or, once you get started, you can employ more powerful editing functions, such as copying the dot pattern in one horizontal row to the row below it.

Jennings has also provided for second thoughts. If you are designing a capital *P* and belatedly decide you want the top section more elongated, you can move the cursor to the point at which you want more elongation, spread apart two adjacent rows, and insert a new row of dot positions between them. Such an insertion pushes the bottom row of dot information off the grid. Where does it go? "To the great bit bucket in the sky," says Hal Jennings.

Deletion of a dot row is also possible, but it brings only a row of blank dot positions into the grid. No dots are retrieved from the celestial bit bucket. Another aid to font creation is the ability to take the shape of a character you have already created and edit it to create others; so the *B* can also become the basis for the *P*, *F*, *E*, and so forth.

"Developing this tool took quite a while," says Jennings. But after he developed it, he realized that he'd won only half the battle. With the design program ready to use, Jennings had to exchange his programmer's hat for a typographer's visor. He chose to make a video version of the type style Garamond, which IBM had settled on as the corporate typeface for the Personal Computer. (Garamond is used in all IBM advertising for the PC, in the user manual, and even on the nameplate of the computer itself.) This became a process of trial and error, attempting to recreate the printed versions of the letter forms using dot patterns on the grid, then refining and refining again. Jennings estimates he spent about 30 minutes designing each character—about a solid week's work.

The process held some surprises for Jennings, particularly when he got around to designing the italic letter forms used to print "Personal Computer" on the screen, the same way it appears on the PC nameplate. "I have a scientific background," Jennings explains, "and scientists like to see things symmetrically. So when I start-

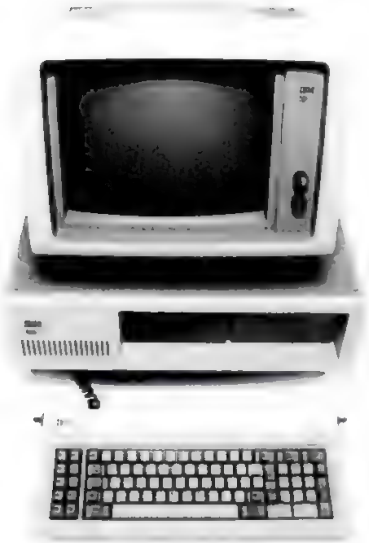
The Hoofing Pachyderm

Jennings' animated reply to an IBM critic.

It seems a computer industry observer commented in print that IBM would have a great deal of trouble being successful in the personal computer business. "It would be like teaching an elephant to tap dance," the analyst said. This comment really stuck in Hal Jennings' craw. So one day he sat down and programmed a picture of a friendly-looking elephant up on his hind legs. A bit more code and there was a nice, rhythmic sound track. Soon the elephant's legs were animated to tap along to the music while the tail wagged to beat time. Finally, Jennings, as both programmer and appreciative audience, programmed in a little crowd reaction to the elephant's performance. "Encore! Encore!" shouts the off-screen crowd. And the elephant dances again.

—*J.E.*

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ed designing the italic letters, I gave them all the same slant. But they didn't look right. Finally I figured out that some of the italic letters, *l* and *p* for example, have different slants. It blew my mind." Perhaps these problems explain why Jennings never finished a complete italic version of the Garamond typeface; he did a full set of the roman Garamond, but in italic he designed only the letters used to spell personal computer. Then, to go with these, he made vid-

SOME OF the italic letters have different slants. It blew my mind.

eo versions of the three letters *IBM* as they appear in the company logotype, allowing a very close reproduction of the PC name as rendered on its nameplate.

Shapes Stored as "DRAW" Strings

When you tell the GCG program you are satisfied with a character design, it processes the pattern you entered in the dot grid. The result is a string of text that is later used as instructions for PC Advanced BASIC's DRAW statement, which recreates your character shape on the screen. (The text in a DRAW string serves as a series of commands for the action of an imaginary pen moving across the screen and leaving dots of light instead of ink.) GCG's screen creation and display parts are built around the DRAW statement. If the shape of a graphics character is very complex, the DRAW string can be as long as 700 characters. This string is stored as the characters' entry in the font file on disk.

With a font designed, you are ready to use the screen creation part of the GCG program. This section of the program can theoretically be used with any font file stored on disk, though Garamond was the only one Jennings had designed at the time of the demonstration.

Jennings' screen creation section allows keyboard control of all the variables in appearance that are possible using the PC's medium-resolution graphics mode. Controls activated by the ALT key allow both foreground color and background color (analogous to ink and paper) to be set either character by character or for the screen as a whole. A clever bit of programming lets text be displayed in certain colors the PC doesn't normally offer, since Jennings' DRAW strings cause the imaginary pen to draw characters by moving up and down in a set of parallel rows, and he allows you to select different colors for alternating rows. Using this ability, you could order odd-numbered rows in magenta and even rows in white. The eye tends to mix colors when they are in alternating one-dot-wide lines, creating the appearance of a pastel purple.

Normally, the screen creation program places a big, blinking square on the display to serve as a giant cursor, initially in the upper left corner. Characters are typed by pressing keys that generate the appropriate ASCII code; so if you had assigned your graphic capital *B* to the same code used for that letter in standard text, then pressing [SHIFT] and [B] together would bring the graphic *B* to the screen. As with normal text typing, the cursor moves right to the next position after a letter is entered, and it will wrap around to the beginning of the next "line" if there isn't enough room for a character on the present line. Both character width and line height are determined by the grid size used in creating the character font.

Since a typeface file can include two variations on a font, such as roman and italic, an ALT key sequence allows switching back and forth between them; thus either a roman or italic *B* could be produced with the B key, depending on which half of the font file was currently selected. If you press a key for which no character has been defined, the program beeps the PC speaker and waits for another choice. Another ALT key sequence allows intermixing of standard-size text with the graphics characters, so the two sizes can be used together in headline and text fashion. In an enhancement of what is usually possible in PC medium-resolution graphics, GCG allows you to select the color of standard-size text. "You have to know the right place to POKE," says Jennings.

Unlike the standard PC display characters, those designed with the GCG can have varying widths and proportional spacing in the same manner as print typesetting—*m* very wide, *a* average, *i* rather

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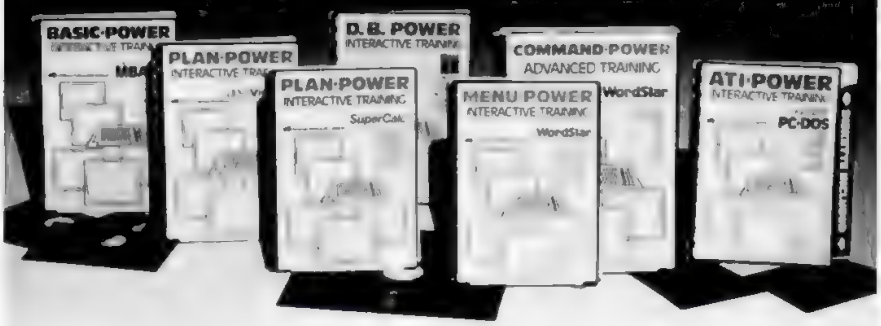
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narrow, and so forth. The screen creation program will take account of this in placing characters along a line, so a line full of the letter *m* might accommodate fewer characters than a line full of the letter *i*. Jennings is especially proud that the backspace key is fully functional on lines of varying-width characters. "How often do you see proportionally spaced characters on a computer screen let alone a destructive backspace that works properly with them?" he asks.

A Keystroke Recorder

To capture screen designs for later use, an ALT sequence turns on a "keystroke recorder" that makes a disk file of all subsequent keys pressed. This facility allows

YOU HAVE to know the right place to POKE.

for a limited range of text animation, since the recorded keystrokes can include control codes for both a timed pause and the clearing of the screen. Another ALT sequence commands playback to the screen of a recorded keystroke set, and the playback commands and display file name can be included when recording, so that one display file can call for the presentation of another. Chains and continuously repeated sequences are possible in this way.

Jennings says characters larger than the 24 by 24 matrix he provides are possible by using the scaling function available with the DRAW statement. Doubling the character sizes this way would be easy, he suggests. Anything much larger wouldn't allow fitting more than a few letters on the screen. He acknowledges that this method of sizing is a compromise because good type design would call for subtle variations as type changes in size. Comparing his work to that of Stanford University's Donald Knuth, a leading figure in computerized design of typefaces, Jennings says, "Knuth is a perfectionist; I'm not in the same class."

Plenty of time went into the programming of the GCG and the creation of the Garamond font. But Jennings says the

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work saved time overall, since he is now able to create text screens for demonstration programs very rapidly. "A good tool goes a long way," he adds.

Two Other Tools

Jennings has also developed two other tools he uses in developing demonstration programs. One is for designing and editing informational screens using the text instead of graphics display mode. This works with the monochrome as well as the color/graphics adapter and allows positioning of text anywhere on the screen. It also allows for changing text attributes such as boldface, underline, blinking, and reverse with keystroke control, and creation of borders using the line-drawing characters provided in the text mode. Once a screen is designed with this tool, it generates a file of BASIC code on disk with all the proper LOCATE, COLOR, and PRINT statements that will reproduce the screen when run. Code produced this way can then be merged as modules into a larger program incorporating a whole sequence of screens.

The third software tool is for creating picture-oriented graphics displays including animation and sound. One of these is an animated sequence of butterflies and flowers that has become a staple in IBM showrooms. Jennings says he was able to develop it over one weekend. The animation works, he explains, by having a portion of the program watch the PC's internal real-time clock, and post messages to the screen management part of the program, informing it when the next step in the animated sequence is due for display. **/PC**

Hal Jennings' demonstration-development tools have obvious potential as commercial software products beyond their internal IBM applications, though it appears no attempt has been made to polish them for consumer sale or develop appropriate user manuals. Following a long-standing IBM policy, neither Jennings nor the company will comment on whether versions of the GCG and other tools might be developed for sale, though IBM spokesperson Jeanette Maher did point out that the company does have procedures set up whereby employee-developed programs can be submitted for possible inclusion in its software line.

The Pachyderm's Choreographer

What does an IBM wiz do away from the job?

Hal Jennings comes across as the kind of guy IBM makes a special effort to bring into its fold. He is earnest, dedicated, and friendly, but when he gets to talking about the work he does, the enthusiasm bubbles right through his otherwise reserved manner.

Jennings is 31, married, and has a 3-year-old daughter. He says he has been fascinated by computers since he was a senior in high school, and the fascination carried him through both a bachelors and masters degree in computer science.

One aid to Jennings' productivity is the IBM PC he bought to use at home—a 64K system with two disk drives, the IBM matrix printer, and both monochrome and color/graphics displays. The computer is kept in the family room and has already begun to interest the youngest Jennings.

Jennings says he likes to program, and that's why he got involved in creating demonstration software, even though he asserts, "Nothing in my job description says I had to do this." His next programming project will be family-related instead of job-related, however. His wife is secretary for her bowling league, and he plans to whip up a bowling league scoring system for her. Jennings seems determined to bring his whole family over to the computer corner of the family room. —*J.E.*



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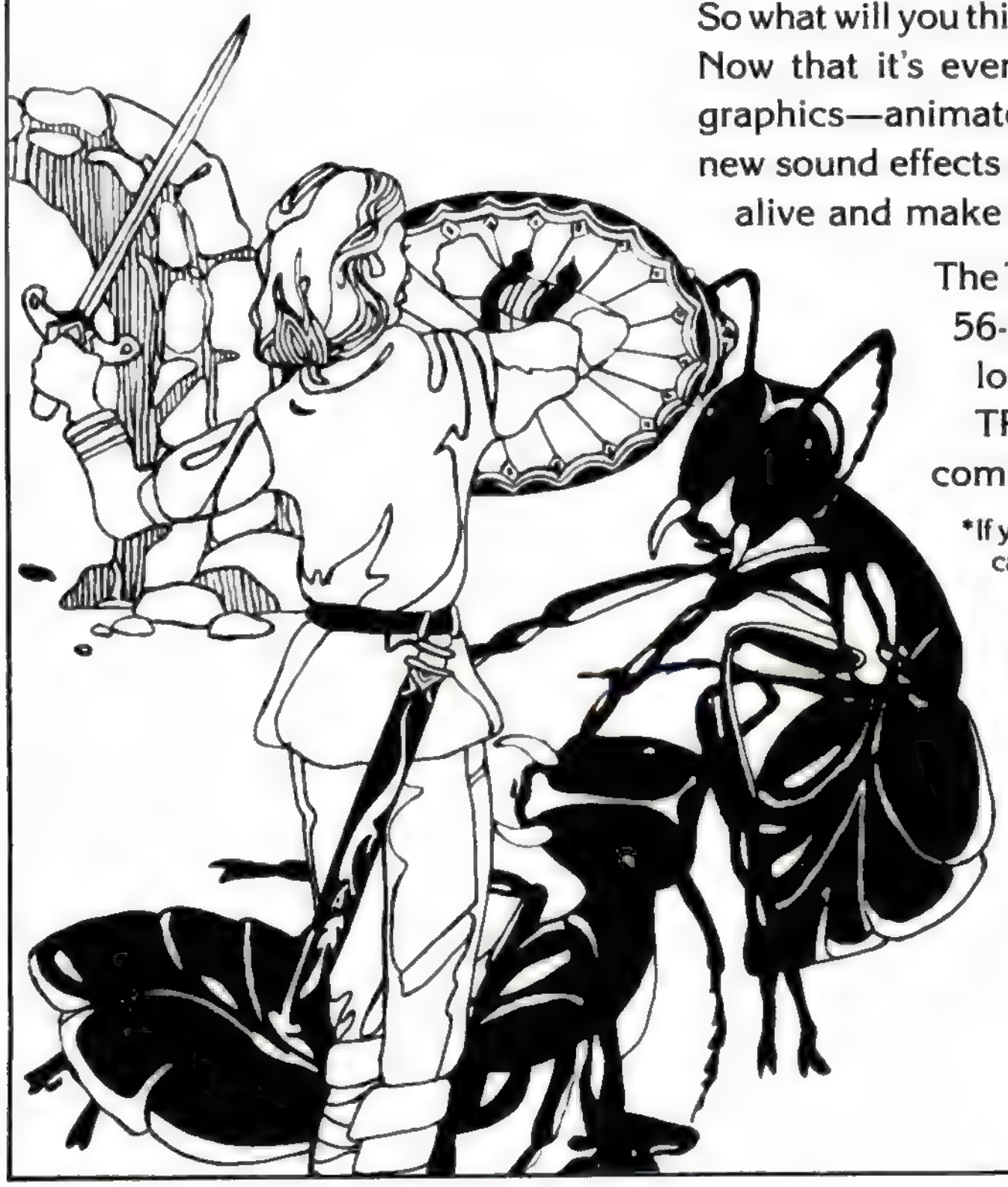
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The p-System is a powerful operating system that includes a comprehensive program development and execution environment (built around the programming language Pascal) and, for the PC, a library of utility programs and other software for accessing the computer's hardware resources. It has evolved from a mostly pedagogical project at the University of California at San Diego, into a modern, highly portable operating system offering many attractive features to the personal and professional programmer, and a growing library of application programs for the end user. According to its developers, Softech Microsystems Inc., future directions for the system include its use on powerful, single-user work stations that are members of a local area network.

The operating system and the operational components are all menu driven. A prompt line of commands is always visible at the top of the screen. Commands are invoked by a single keystroke, and the organization of the system is hierarchical. Pressing a key generally causes an action to be taken or brings forth a new prompt line at a level lower in the hierarchy. This style is very pleasant to use and it is uniform throughout the entire system.

THE TYPIST need not press a return key to indicate the end of a line.

The p-System provides the support expected of an operating system. It handles all interaction with the keyboard, video displays, printers, and disks and provides a file and directory system for storing and manipulating data. It also insulates the programmer from having to know the details of how peripheral devices work. This is done via uniform handling of all devices at three levels of software control. The levels range from unformatted, byte-stream input/output (I/O) to structured, record I/O. All I/O procedures are directly available to the programmer.

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ming environment conducive to the development and execution of programs. This environment is an integration of:

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- a program development environment that to date supports three programming languages with a modern library and separate compilation facilities.
- a sophisticated program execution environment that includes automatic memory management for large programs, access to the 8088's large address space, redirection of program I/O, and chaining of programs.

The program development environment offers many facilities, including an editor, a file handler, various high-level language compilers, a conditional macroassembler, several library maintenance utilities, a symbolic debugger, a library of software to access hardware resources (such as the graphics screens, game paddles, and special function keys), and operating system facilities (such as the file management routines).

The Program Preparation Environment

Outstanding support for preparing program texts and editing other textual material is provided through the p-System editor. The editor is screen oriented; what you see on the screen is what you get on the printed page. It doesn't have embedded formatting commands. The editor is character oriented; all editing functions take place at the location of the cursor. And it is single-keystroke menu-driven.

The editor supports a set of general purpose editing commands including insertion, deletion, global search, search and replace, block moves, substituting text, user-selectable tab stops, and a method for aligning columns of text. The editor is also dual purpose, being well suited to editing text and preparing programs. The purpose for which the editor is to be used is set by command. This can be varied repeatedly during an edit session and can also be saved on disk with the text.

In program editing mode, the editor provides automatic indentation of lines. The cursor automatically follows the indenting format characteristic of the programming language being used. Text editing mode features automatic paragraph indenting and formatting, adjustable left and right margins, and automatic line wrap around. With line wrap around, the typist need not press a return key to indicate the end of a line.

Note that the p-System editor is not a full word processor. Overstriking and sub-

THE BASIC program editor is less flexible than the p-System editor.

and superscripting are not supported, and footnotes have to be placed manually. Nevertheless, we have found it satisfactory for the majority of text processing tasks, and it is an excellent editor for preparing program texts. Also available are a number of typesetter-style word processors that use text formulated in the editor as input and produce highly formatted text as output.

The p-System's file handler is similar in function to the CHKDSK, COPY, DATE, and DIR commands of PC-DOS. It handles all housekeeping chores relating to the maintenance of disk files, including copying files and disks.

The Program Development Environment

Using the p-System, you can develop programs on the PC in three languages: UCSD Pascal, FORTRAN-77, and 8087/8088 assembler. Pascal and FORTRAN compile to "p-code" (machine code for a hypothetical processor, "the p-machine") which is then executed by a memory-resident p-machine emulator. By virtue of this design and the ability to compile libraries of routines, languages can communicate with each other. The standard p-System (at $625) includes Pascal and the assembler with an option to add FORTRAN and other languages. All languages share the same program preparation environment.

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UCSD Pascal is an extension of the Pascal language defined by its creator Niklaus Wirth. For lack of a formal standard, Wirth's has become the basis for most versions of Pascal. UCSD Pascal includes all the salient features of Pascal, such as data structuring declarations, program control statements (WHILE . . . DO and REPEAT . . .UNTIL loops), and block-structured syntax. It also offers a variety of built-in procedures for handling strings, performing fast, directing I/O devices, and managing concurrent processes.

Compiler Features

The UCSD Pascal compiler is a conditional compiler, meaning designated portions of a program can be compiled according to options set at the beginning of the program text. Other compiler options allow the programmer to control the amount of error-checking code produced. These are useful for saving code space and execution time after a program has been fully developed and tested.

To get a feeling for how gracefully the p-System supports program development, one need only write a program with a mistake in it. If the compiler detects a syntax error, it passes an indicator of the location of the error back to the editor so that the editor can place its cursor on the offending symbol. The editor is also sent the nature of the syntax error and gives the user an English-language message describing the error. The system can also be set up so that this interaction between the compiler and the editor is fully automatic. Unless you never make mistakes, you will probably find this feature useful.

Assembler with a Purpose

The UCSD assembler supplied for the PC is a conditional macro assembler for the 8086, 8087, and 8088 processors. The most frequent use of the assembler within the p-System environment is to develop small, special-purpose machine language routines. The assembler is equipped with a number of directives that facilitate data sharing between assembly language and high-level routines.

The standard Pascal language has been criticized for failing to define software modules that can be compiled separately and linked into programs as needed. Newer languages, such as Ada, are praised for providing this definition, as are compilers for older languages such as FORTRAN. Since its inception, UCSD Pascal has included libraries of program modules, or units, as a significant component of the language. The current version of the language is no exception and the feature is quite powerful.

A Fine-Tuned Unit

A UCSD unit consists of two major pieces: the unit interface and the implementation. The interface defines a set of services the unit will provide to any program that uses it. The implementation is the unit's method of providing those ser-

The P-Machine

The central concept of the p-System and the key to its portability.

Underlying the p-System is a hypothetical machine called the p-machine. The p-System compilers create codes for this machine. These codes are then executed by a resident p-machine emulator written in the native language of the host processor, in this case the 8088. The goal in this design is to have an operating system that is compatible with a variety of microcomputers. This goal has been substantially achieved. The benefit to the system's developers, program developers, and users is the ability to transport the entire computing environment without loss, including all applications programs and utilities.

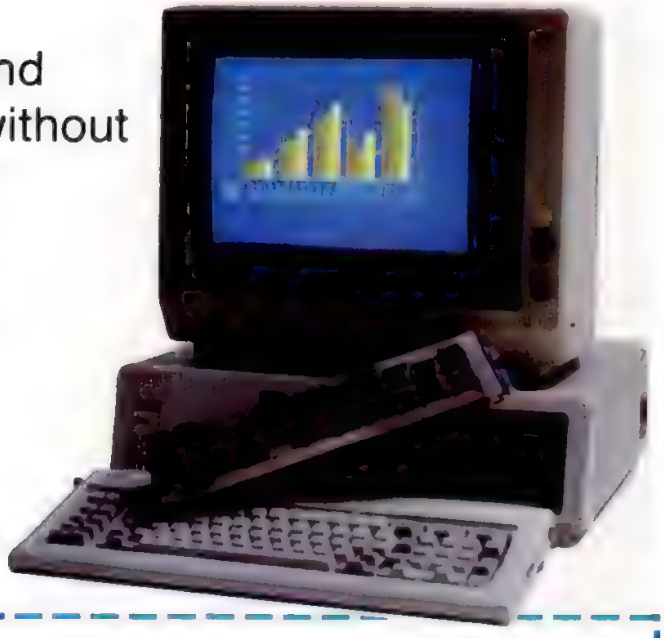
On the other hand, the hypothetical machine design of the p-System can be regarded as an annoying, time-consuming overhead by the end-user of a finished program. One solution to this problem is the Native Code Generator, which translates p-code files into files consisting of a mixture of p-codes and 8088 machine codes, enabling the program to run faster. The p-machine emulator is able to recognize these mixed code files and will turn control of execution of the native code sections over to the 8088 as appropriate. Note that the Native Code Generator does not translate all p-codes into native codes. It can, however, translate all floating point arithmetic p-codes into instructions for the 8087 floating point co-processor.

—T.H.W. & A.F.



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vices. The interface of a unit is fully accessible to the calling program, but the implementation is of concern only to the unit itself. In this way the services provided by the unit can be speeded up, made more efficient, or otherwise changed without affecting any other program.

The feature's advantages to the programmer cannot be overstated. They allow the programmer to design a program as a set of general-purpose and special-purpose units. All units can be separately developed, compiled, and tested, and then incorporated into the overall design as they are completed. The general purpose units can be used over and over with the knowledge that they are bug-free and perform to specification.

FORTRAN Interface

Pascal units can use FORTRAN units and vice versa, and both can be linked to assembly language routines. The ability to communicate between Pascal and FORTRAN might be especially attractive to those who wish to take advantage of the large library of scientific subroutines written in FORTRAN.

The Program Execution Environment

The program execution environment includes features of the operating system and utility programs such as memory management, the ability to execute large programs, and interprogram communication. For the p-System the program execution environment includes standard units that may be used by the applications program.

The p-System's strategy for managing memory during program execution makes compiling and executing very large programs possible. Each UCSD unit is treated as a swappable segment of code, or memory overlay. Portions of programs and units can also be designated as swappable segments. The system always knows which segments are present in memory and where the remaining segments are located on disk. When a segment is called, the system checks for its location. If it is not resident, the system reads, or swaps, the segment into memory.

If there is insufficient room for the segment in memory, the system swaps segments that are not currently needed out to the disk. The same strategy is applied to the operating system code segments; only those segments of code needed to execute a program are stored in memory. This strategy combined with good program design makes developing and executing large applications programs possible.

Minimizing Costs

All this code swapping has its price, but there are ways to minimize costs. The programmer can control residency of program segments from within a program via a pair of built-in procedures that lock and unlock segments in memory. A second solution (the hardware solution) is to add more memory to the PC.

The p-System also permits "exec" files so that a series of commands for executing programs can be organized into a single job and executed as a unit without further attention.

Memory Requirements

The minimum memory required by the p-System is 64K, although the system can use up to 128K. Any memory over 64K is reversed for code segments as part of a code pool. In a 128K machine, 64K are available for data, and another 64K are available exclusively for program code. The p-code produced by the p-System compilers is quite compact, and the number of code segments that can be resident in the code pool will usually be quite large. Code segment swapping will be dramatically reduced in a 128K machine.

In addition to segment swapping, the system provides program chaining—one program can call another. When the calling program exits, complete control is given to the called program and communication between the programs is possible.

The UCSD p-System is a mature and powerful operating system. The portability and compatibility inherent in its design result in a product we recommend to all PC owners. **/PC**

Tom Woteki has been working with microcomputers for over 2 years and is an acknowledged expert in UCSD Pascal. He is currently a member of the faculty at George Washington University where he teaches Pascal. Alan Freiden has 6 years of microcomputer experience and has published numerous technical articles. He currently teaches computer graphics.

According To Softech

SofTech Microsystems, which markets the UCSD p-System, offers an explanation of how the p-System ticks.

The p-System gained its fame while known as the UCSD Pascal System. Somewhere along the way, perhaps because of its strong association with the Pascal language, the underlying operating system was obscured. As a result, the technical community as a whole is relatively unaware of the power of the p-System operating system. Otherwise well-informed professionals in the microcomputer industry think the p-System is "only a Pascal compiler." Such misconceptions arise because the usual access to the p-system is through the facilities provided by the UCSD Pascal language. To understand the full power of the operating system you should think of it in more traditional ways.

Following are useful facts about the p-System.

- The p-System runs on all popular 8- and 16-bit microcomputers, including the 68000; it has been running on 16-bit microcomputers such as the DEC LSI-11 and the TI9900 since 1977and is now running on the 32-bit VAX.
- It supports UCSD Pascal, FORTRAN-77,

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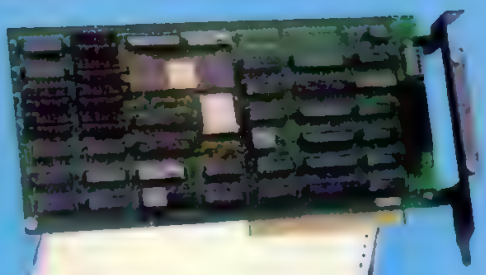
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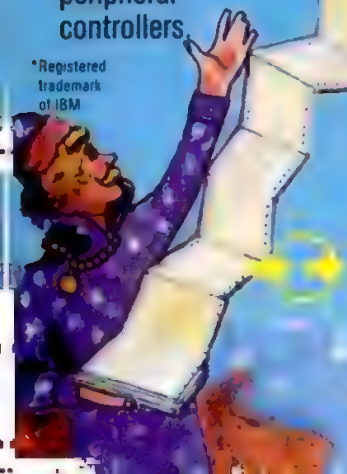


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BASIC, and assembly language for ten microcomputer processors.

- A compiled application program can be executed without change or recompilation.
- The p-System runs most major microcomputers including Apple II, Osborne I, IBM PC, Commodore, TRS 80, Ohio Scientific, Xerox, Hewlett Packard, Philips, Texas Instruments, Zenith, and the new DEC Professionals.
- The system has been used for a very wide range of applications including the *Wizardry* game, *PFS*, *VisiSchedule*, accounting and financial systems, graphics composition for broadcast television, and real-time control of solar collectors.
- Full-scale software development systems are running on over 75,000 personal computer systems.

The p-System provides professional software developers with the means to write truly portable programs in a wide range of application areas and to distribute those programs across a broad spectrum of the personal computer market.

System of Facilities

What distinguishes the p-System is the way in which its facilities are integrated. It is a system of facilities in which each component benefits from other components.

The p-System, developed at the University of California at San Diego (UCSD), contains over 500,000 lines of source code. This integrated system can best be surveyed by examining the various major components and seeing how they work together.

The Command Language

Usual contact with the operating system is through the command language. The command language of the p-System is designed to be used interactively from the keyboard. It strikes a balance between simple, single-keystroke commands and understandable, easy-to-remember English language commands.

The commands are arranged as a tree. When the user selects a command, the next set of commands becomes available. A single keystroke invokes any command from the menu displayed at the top of the screen.

The operating system also provides the means to execute a series of commands contained in a data file. Usually referred to as a batch or command file, such files are ordinary text data files that can be prepared or modified with the standard screen oriented editor.

I/O Redirection

Like most modern operating systems, the p-System allows the user to specify the names of files containing input data and receiving output results.

When a data file is not specified, the system will assume that input should come from the keyboard, and the output should go to the screen.

I/O redirection is a very powerful set of facilities. It allows defaults to be changed from the keyboard or by a program. One can also use I/O redirection to construct application programs that use program to program communication.

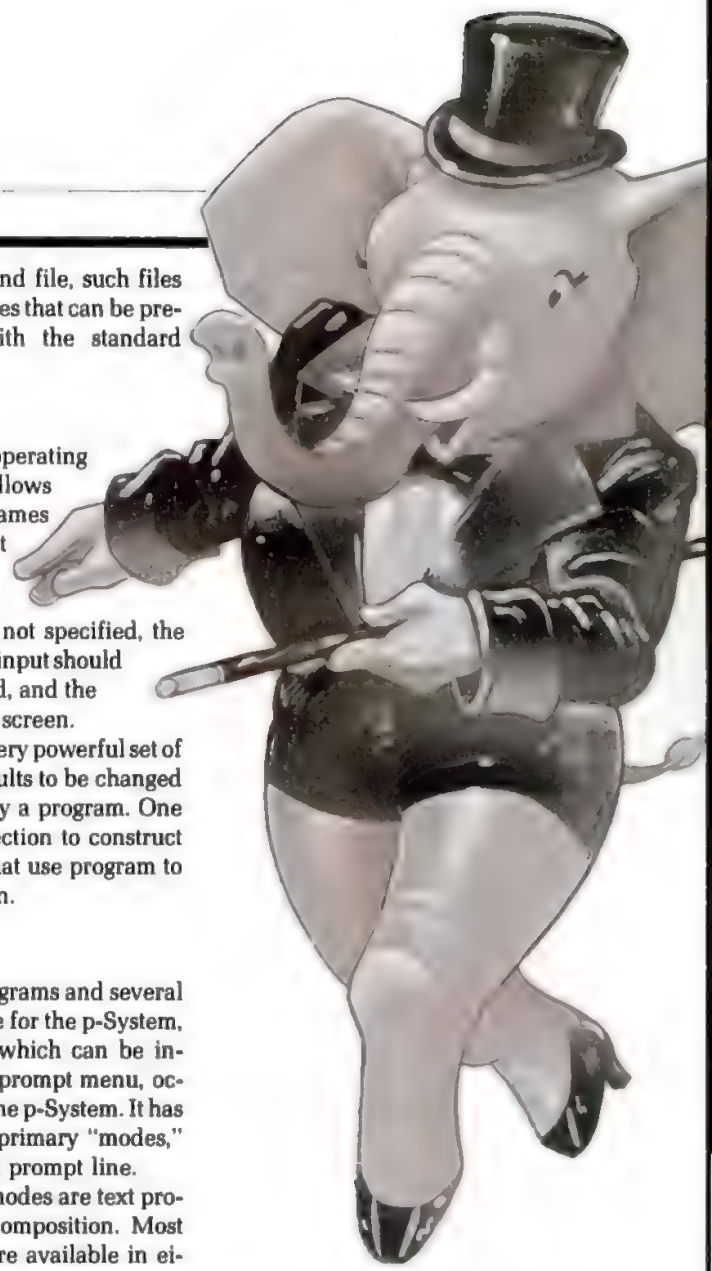
Editing

Word processing programs and several text editors are available for the p-System, but the system editor, which can be invoked from the system prompt menu, occupies a special role in the p-System. It has many options and two primary "modes," selectable from a menu prompt line.

The two supported modes are text processing and program composition. Most features of the editor are available in either mode, but the few differences are very useful. In the text processing mode, left and right margins and paragraph indentations can be pre-set. Words are automatically moved from the end of one line to the beginning of the next if established margins are necessary. Carriage returns are used to indicate a new paragraph. Margins may be reset, and paragraphs may be selectively remargined.

The program composition mode deactivates the automatic margin features but provides "automatic indentation." When this feature is active, the cursor position can be adjusted, left or right, before entering text on the new line. This mode is helpful when the indentation of the source lines is used to show the organization of the program.

The operating system also provides support that connects the editor and compiler. When a compiler encounters an error it asks whether to return to the editor to correct the program. If the user says yes, the compiler stops and the editor is called. The editor gets the program source file and positions the cursor at the error. This is just one of the many ways the p-System integrates its components to make the software easy to use.



The Filer

The filer is in some sense the secretary of the p-System. Like other major components, it uses horizontal menus and single-keystroke commands. The p-System allows users to refer to disk storage by specifying volume names for diskettes or by specifying a device. It also provides quick and easy ways to refer to two special volumes: the system, or "boot" disk, can be referenced by the shorthand name "*", and a default volume name, which will be used if no volume or device is specified.

The filer is designed to provide as much safety as possible for the user. Operations such as file deletion require users' confirmation to carry out the oper-



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ation.

The filer permits users to perform a single operation on an entire collection of files. One can, for example, transfer all files from one volume to another. It does so by allowing either of two "wild card" characters ("=" or "?") in most commands to be a part of any file name specified. Deleting "=REPORT" will cause all files with names ending with "REPORT" to be deleted. The filer will confirm the delete command. If you delete the file "?REPORT," the filer presents a list of files, allowing you to delete them individually.

Finally, the filer shows a list of all files deleted and asks you to confirm that you really want those files deleted.

The Work Files

Several parts of the p-System support work files. You designate a file as the current work file, and the system assumes you want to use that file unless you specify otherwise. When the editor asks for the name of the file to be edited, press the return key, and the editor will open the work file.

Programming Languages

In addition to assemblers for ten different microprocessor CPUs (all of which support conditional assembly and user-defined macros), the UCSD p-System provides UCSD Pascal, FORTRAN 77, and extended BASIC compilers as well as a collection of native code generators. Programs written in any of the three languages can call procedures (subroutines or subprograms) written in any of the other languages or assemblers.

Native code generators are available for most popular microprocessors. They allow the programmer to fine-tune parts of a program for speed and space efficiency.

UCSD Pascal, FORTRAN 77, and BASIC allow programs to use libraries of common routines. Since all three high-level programming languages support separate compilation, users can develop their own libraries of routines.

The three languages allow programs to be made up of pieces, called segments. Segments are managed by the operating system memory management facilities so that only two such segments have to be in memory at one time. Automatic memory management is one of the most important features of the p-System.

UCSD Pascal has the most advanced features. The language is described in detail in the *UCSD Pascal Handbook* by Randy Clark and Stephen Koehler, but one feature—units—depends upon the cooperation of the operating system and is perhaps the single most important feature of UCSD Pascal.

The basic idea is quite simple: UCSD Pascal allows a collection of declarations and procedures to be compiled as a unit. A unit is divided into two sections, Interface and Implementation, corresponding to the specification and implementation procedures in the unit. The Interface section defines the interface to the outside world with data and procedure names other programs can use. The implementation section defines how data and procedures are implemented and what kinds of data are used internally. Programs that use units can be changed and recompiled without recompiling the units themselves. If only the Implementation section of a unit is changed, the programs that use that unit don't have to be recompiled.

THE P-SYSTEM provides virtual memory services even though the underlying hardware may not.

The units feature of UCSD Pascal supports the software engineering principle, "information hiding." This feature is used extensively in the operating system itself to provide services to programs. Many of the features of the UCSD Pascal language are implemented in the form of units in the System Library. Units provide part of the magic that allows the p-System to grow and change without requiring existing user programs to be changed.

Symbolic Debugging

Although it has never been really clear whether it is easier to avoid putting bugs into a program or to dig them out once they're in, digging them out is sometimes very difficult. Special facilities in the UCSD Pascal compiler, the operating system, and the Symbolic Debugger provide a very powerful tool for debugging user programs.

The UCSD Pascal compiler provides the Symbol Debugger with a description of the symbols used in a program. The programmer inserts break points at which the program will stop. When break points or an execution error occur, the programmer can examine the data and program using the names that were used when the program was written. Although it takes the cooperative efforts of the Pascal compiler, the Symbolic Debugger, and the operating system, the effort is well spent because it allows the programmer to debug the program at the design level.

File Management System

The file management services of the UCSD p-System support binary and text data files, serial and direct access, and the traditional services for opening and closing files. The latest release of the UCSD p-System provides, in the form of a collection of units, many useful procedures for managing disk storage. A program can call these procedures to delete or rename files and volumes.

Both files and removable file storage volumes such as diskettes may be given names. A file name can contain up to 15 characters, and the volume name may contain seven characters. The special volume name, "*", and the defaults described for the filer are all supported in the file management services.

Screen Control Services

One of the principles that has guided development of the p-System is that both operating system and application programs developed by its users should appear the same even when they execute on different microcomputer systems. The screen control unit of the operating system is provided so that system programs and application programs can deal with displays and still maintain portability.

Perhaps the greatest demonstration of the success of the screen control unit is that it is used by the screen oriented editor to provide on-screen editing features.

Memory Management

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grow rapidly, so do our ambitions for the use of that memory. The p-System manages the use of memory, dynamically allocating memory for data. It brings program segments in from disk when they are required and moves other segments around in memory to make room for new ones. If not enough memory is available, the operating system will automatically release some program segments (choosing those that were least recently used) to make room. The operating system allows the programmer to define the segments of a program so that it may be made up of many small segments or a few large ones, depending on the nature of the application. The p-System provides virtual memory services even though the underlying hardware may not.

These services have the same kind of true portability as the remainder of the p-System. An application program that has 80K of program segments and needs 20K for data can operate on an Apple II with a 6502 CPU and only 64K. That program can be moved, without recompiling, to an IBM PC with an 8088 CPU and 128K.

When the program is running on a 64K Apple II, it may frequently page program segments in from the disk, but when it is moved to the IBM PC, the operating system will automatically take advantage of the additional memory, and the performance will improve considerably. Personal computer owners can purchase additional memory, install it in their system, and the p-System will make it available to the application programs automatically.

Concurrency

True concurrency would require more than one processor. The concurrency services of most modern operating systems, including the p-System, would be better described by terms such as "apparent concurrency" or "logical concurrency."

Concurrency services in the p-System allow an application program to be organized as though multiple processors were available to do the work. The portions of a program that could be executed in parallel on multiple processors are called "processes." Operating systems for single processors provide concurrency services for two reasons. These services allow programs to be organized in ways that are otherwise impossible. A program can be organized, for example, using processes and "co-routines." Co-routines don't act as subroutines. They pass control back and forth like a ping pong ball, essentially saying to each other, "I'm through, it's your turn." Some application programs can more easily be organized as a set of co-routines (processes) than a hierarchic set of subroutines.

UNITS provide part of the magic that allows the p-System to grow and change without requiring existing user programs to be changed.

The other, more important use of processes and concurrency is providing a means to deal with external, asynchronous events. Consider a home control system. It might contain several processes, such as one that turns lights on and off at certain times and one that closes windows if a moisture sensor indicates rain. Each of these processes is relatively independent of the other, and the programmer who is writing the home control system can't tell in advance the order in which things should be done. The best way to organize such a program would be to have a set of processes that are started when an interrupt from a clock or sensor indicates a specific process should start.

The concurrency services of the p-System allow programs to be organized in ways that are otherwise impossible. Co-routine programs may be written, the home control system can be written, and the "Print Spooler" available with the p-System makes use of concurrency facilities to provide its services.

The Print Spooler takes on the job of printing text files, doing so only when the computer has nothing else to do. By using the Print Spooler you can edit one text file while printing another. The Print Spooler uses the concurrency features of the operating system so that when the system is waiting for the user to enter commands or text, it momentarily takes over and spools text files to the printer.

The concurrency facilities of the p-System include process control services such as START and WAIT, and process communication services such as SEMAPHOREs and SIGNAL. In terms of a traditional description of an operating system, the concurrency features provided mean that the p-System is a multitasking but not multiprogramming operating system. Although a program can be quite large, contain many completely independent processes, and serve several users at different terminals, the operating system will allow only one program to run at a time. Although a multiuser application program can be written, the p-System will not allow more than one program to use the system at a time. It is not a timesharing system; it is a system designed to provide a wide range of services on a personal computer.

General Utilities

Many other services in the operating system are available to an application program, including such things as menu display and selection procedures and string manipulation routines. Other facilities are available in the system library, such as those that provide program chaining and I/O redirection. Several specialized libraries provide forms data entry, indexed or keyed sequential (ISAM and KSAM) file access, access to CP/M files, and graphics display procedures.

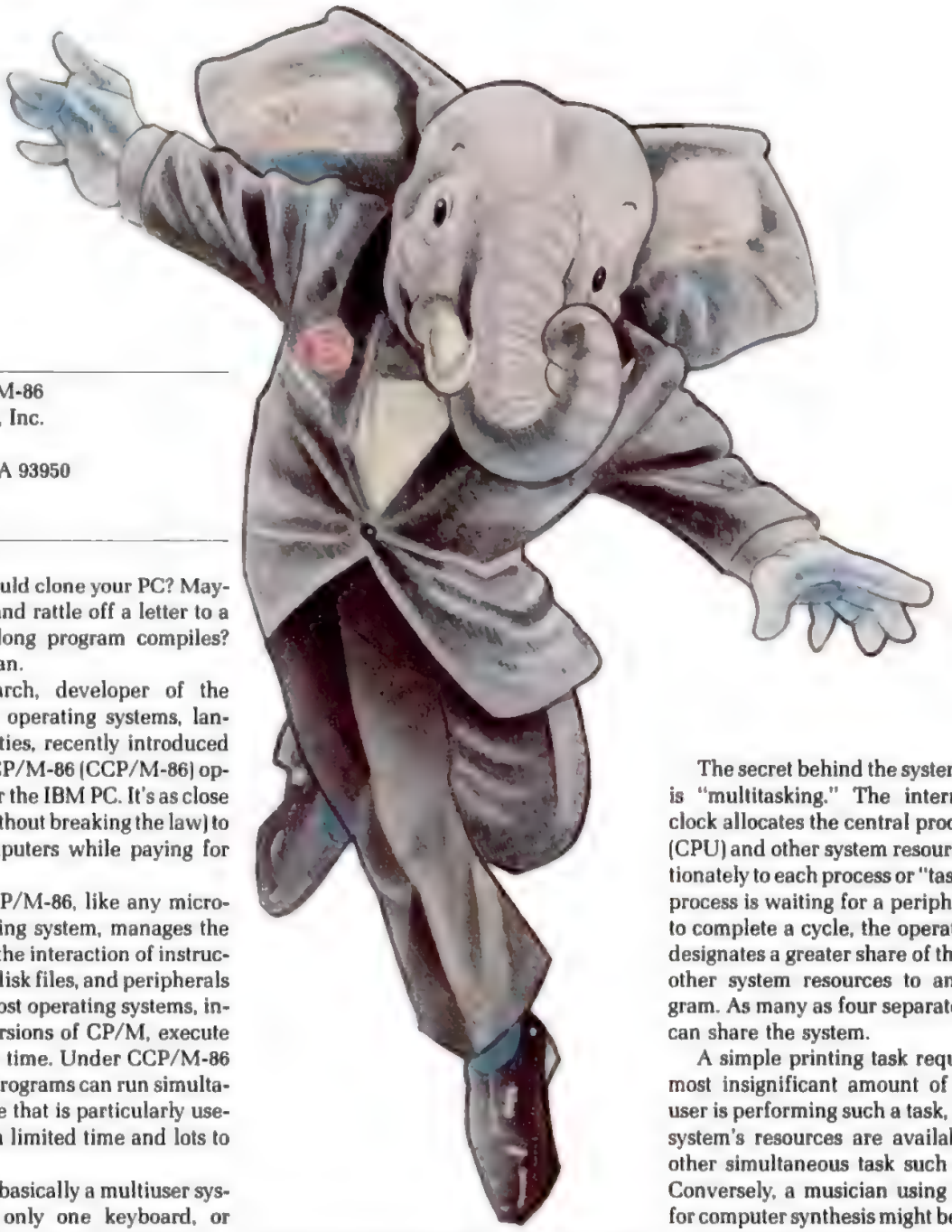
In addition to the p-System facilities offered by SofTech Microsystems, independent software houses offer libraries of units, such as those that provide the full SIGGRAPH Core Graphics Standard. Such independently produced libraries of units appear to the programmer to be compatible extensions to the p-System.

The p-System is a portable operating system that can be used to develop portable applications programs. It is a user-friendly, menu-driven system. It is an interactive operating system for personal computers. It is an integrated, multilingual, multitasking operating system. It is a modern, virtual memory operating system supporting modern software engineering techniques. It is an operating system for 8-, 16-, and 32-bit machines.

C. A. Irvine
Director of Engineering
SofTech Microsystems

Concurrent CP/M-86

An operating system that enables the user to run four programs simultaneously.



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Ever wish you could clone your PC? Maybe play a game and rattle off a letter to a friend while a long program compiles? Well, now you can.

Digital Research, developer of the CP/M family of operating systems, languages, and utilities, recently introduced the Concurrent CP/M-86 (CCP/M-86) operating system for the IBM PC. It's as close as you can get (without breaking the law) to having four computers while paying for one.

Concurrent CP/M-86, like any microcomputer operating system, manages the flow of data and the interaction of instructions, programs, disk files, and peripherals in the system. Most operating systems, including other versions of CP/M, execute one program at a time. Under CCP/M-86 as many as four programs can run simultaneously, a feature that is particularly useful for users with limited time and lots to accomplish.

CCP/M-86 is basically a multiuser system supporting only one keyboard, or physical console. While CCP/M-86 requires a minimum configuration of two disk drives, it operates most efficiently in a system using a 10-megabyte hard disk. The system also requires 256K, as the operating system alone requires 90K. CCP/M-86 works with both high- and low-resolution monitors in color and black and white.

The secret behind the system's abilities is "multitasking." The internal system clock allocates the central processing unit (CPU) and other system resources proportionately to each process or "task." When a process is waiting for a peripheral device to complete a cycle, the operating system designates a greater share of the CPU and other system resources to another program. As many as four separate processes can share the system.

A simple printing task requires an almost insignificant amount of CPU. If a user is performing such a task, most of the system's resources are available for another simultaneous task such as editing. Conversely, a musician using the system for computer synthesis might be interested in performing a Fourier Analysis on a complex wave form. Because this would require extensive internal calculations and consequently more CPU, the musi-

cian would find the response time on a secondary task about 50 percent slower since more CPU is required for the wave form analysis.

Features

While the system can be beneficial to the single user, CCP/M-86 supports up to 16 users and disk drives of up to 512 megabytes each, plus the full 1 megabyte address space of the 8088 processor. The 128 file capacity of each disk is assigned on a first come, first served basis.

A carefully designed feature of the system ensures that any file, once opened,

WITH CP/M-86 Digital Research has made a substantial improvement in the quality of documentation.

cannot be accessed by a concurrent process unless it was opened in "shared" mode. This prevents one file from being accidentally deleted by another. Likewise, the disk system must be reset before changing disks to prevent accidentally changing a disk that contains an open file in use by another process. The directory will indicate only a particular user's files. All other files (except those with password protection) are accessible to all users when desired.

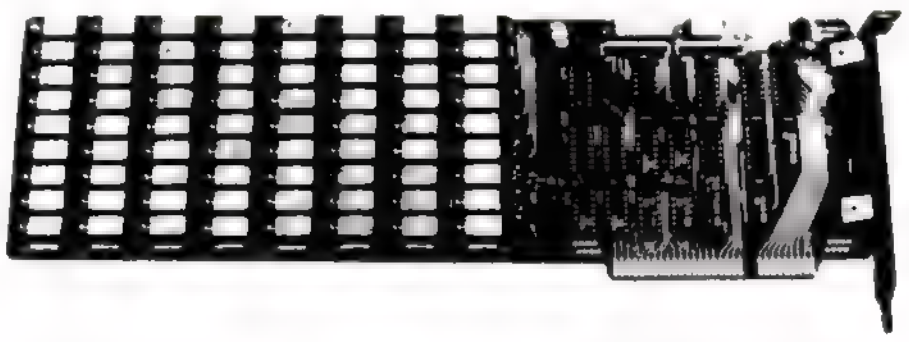
The real-time monitor is the intelligence behind the system. It keeps all tasks and files separated, schedules all internal timing to execute the various processes, and manages the logical I/O and interrupt. Part of the monitor's job is queue management. A queue is basically a data pipeline between two concurrent processes. The monitor assures that two processes don't try to use the same I/O device at the same time.

The monitor constantly polls peripheral devices, such as the printer, for readiness and assigns tasks to these devices as required. Where four letters are in various stages of preparation for mailing, the first is being printed; the second is in the print

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queue; the third is running through a program that checks spelling; and the fourth is being entered or edited. The monitor polls the printer. When it has finished the first letter, it brings the second letter out of the print queue and prints it. When the third letter is ready for printing, it moves into the print queue, and so on, until the task is completed.

CONCURRENT CP/M-86 should shine brightly in a multiuser, hard-disk environment.

All programs running under the system are controlled by four virtual consoles similar to the channels on a TV set. The user can instantly switch "channels" by pressing the Ctrl key and the appropriate number key (0 through 3) addressing the desired virtual console. This feature is particularly useful for a user who employs a modem. If, for example, the user is in the middle of a complex task and receives a modem call, there's no time to save the task on a floppy disk. The user switches to another virtual console, quickly loads the modem program, and accepts the incoming data without losing the data from the file that had been left to accept the call. The growth of telecommunications may expand the applications of this feature.

Operation

For all its internal complexities the operation of CCP/M-86 is relatively straightforward. The user loads the program by inserting the boot disk (supplied by Digital Research) into drive A, and the system disk into drive B. The boot program loads the operating system into memory. The user replaces the boot disk with an application software disk (the system disk stays in drive B) and it's ready to go.

When the system signs on, the display will indicate which, if any, peripherals are supported, and the prompt "0A" appears on the display ("0" indicates user number, and "A" tells which disk drive address is logged). The bottom line of the monitor

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constantly displays system status data such as what program is running on the open virtual console, the current system printer (if any), the name of the process that is currently running, the time of day, and other information.

The user calls applications software or system utilities by typing a command on the current virtual console. The system checks all the resident utilities until it finds the right file. After the process is loaded and running, the console switching feature can set up several processes that refer back to each other.

The user becomes multidextrous. He or she may call for the directory of available files on console 1, switch to console 2 and load the printer program to print the files in the directory, load a word processor into console 3, and load a modem program into virtual console 4. At the same time, he or she can edit an article, copy the first file from the directory, and switch back to the directory to copy all the other files while waiting for the modem call.

Performance

CCP/M-86 performance compares favorably with the CP/M-86. However, the execution speed for any given process is proportionately dependent on the share of required I/O or CPU resources. For instance, loading basic CP/M-86 from disk required 5.7 seconds while loading CCP/M-86 took 6.0 seconds; loading DDT-86 on another virtual console with a continuous display, and simultaneously loading CCP/M-86, required 8.6 seconds. Therefore, a relatively heavy I/O load, or running two processes at the same time, did not demand too much from the system. However, running a BASIC program that is performing a large number of mathematical calculations, and loading the system, requires a relatively cumbersome 9.2 seconds.

Documentation

With CCP/M-86, Digital Research has made a substantial improvement in the quality of documentation. The first version of CP/M was developed when microcomputer enthusiasts assembled systems in their basements and garages and entered program code by switching it manually, bit by bit, into the systems. Although CP/M's inventor, Gary Kildall, realized that his new operating system would give much greater scope to the microcomputer engineer, he probably never dreamed it would be employed in so many nontechnical ways.

Now, with the entrance of CP/M-based microcomputer systems into home and business environments, nontechnical users find the program's command language difficult to learn. Part of the confusion lies in unclear documentation, primarily written for computer professionals.

CONCURRENT CP/M-86 will likely become the yardstick for measuring other personal computer operating systems.

In truth, even professionals are reduced to trial and error tactics. The new documentation, while not up to the standard of Hewlett-Packard's hardware manuals, is a vast improvement over the inscrutable set of computer printed, xeroxed pamphlets that came with the earlier versions.

Both the *User's Guide* and *Programmer's Guide* are well-organized, comprehensive, and readable. The *User's Guide* is especially noteworthy. Basic material about applications software appears at the beginning; definitions of concepts appear throughout the manual; and detailed explanations of command syntax and options are presented in later chapters. The *Programmer's Guide* covers theories on concurrent multitasking operating systems, as well as explanations of the functions of CCP/M-86.

The *Programmer's Guide* has no syntax examples of the assembly language statements in the material on ASM-86, nor explanations of what the instructions do. My programmer friends complain that they are forced to use a hit and miss approach to identify the syntax acceptable to the assembler. Since Concurrent CP/M-86 is configured for the IBM PC only, no system guide is supplied. Digital Research, however, plans to release a generic version of the system that will be user-confi-

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gurable to any 8086-8088 hardware environment.

Product Support

Generally speaking, Digital Research's support of its products is good. It has recently added several customer support and quality assurance personnel; however, there is still room for improvement. I had to make three calls recently before receiving the answer to one programming question.

Evaluation and Recommendations

Concurrent CP/M-86 should shine brightly in a multiuser, hard-disk environment. It will also benefit the single system user. Although the strengths and potential applications of CP/M-86 are enhanced by the multitasking features of the Concurrent version, CP/M's inherent weaknesses become more apparent. This criticism applies particularly to the difficult task of making a suitable operator interface. This limitation could be overcome by implementing a customizable, menu-driven command preprocessor such as those available for other CP/M operating systems. Digital Research may make such a tool available in the future. Some system utilities in CCP/M-86 are menu-driven, but not enough to reduce the clumsiness of the interface. Another useful addition would be a more modern and convenient text utility.

No software system can be all things to all users, but judging from user interest, CCP/M-86 comes closer than any competitive product. CCP/M-86's ability to run four concurrent tasks makes it useful for a software house involved in tasks as diverse as configuring robotics, process control, and laboratory data acquisition. It is equally useful for the sophisticated small office or home environment.

Concurrent CP/M-86 will likely become the yardstick for measuring other personal computer operating systems. The ultimate success or failure of the product will depend upon the efforts of creative applications programmers to orchestrate its features. With CCP/M-86 and the IBM PC, software suppliers are given the basics to generate productive applications systems. The question is, how well are they going to utilize this potential for the benefit of the user? */PC*

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PC Reviews IBM COBOL

A pragmatic look at some of IBM COBOL's principal features and why they make this language a first-rate productivity tool for business applications.



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For the developer of business applications, IBM's COBOL compiler stands above all other languages currently offered by IBM for the Personal Computer. Mine is not a theoretical conclusion arrived at by browsing through the manual. I have completed a comprehensive accounting and tax system consisting of a suite of 18 major COBOL programs that occupy almost a half-megabyte of disk space for the object code alone. These COBOL programs have proven robust and reliable. Before software will achieve a more user-friendly aspect, the development tools will have to be considerably more programmer-friendly. This COBOL is a huge stride in that direction; it's a first-rate productivity tool.

When I point out differences between COBOL and other languages, I do so in order to compare, not criticize. Those who engage in endless, pointless language wars overlook the fundamental fact that each computer language was designed to perform specific tasks. An all-purpose language does not exist today for many reasons, not the least of which is that such a language would be of staggering size and complexity. If you view languages as tools, why not have the best one for the job?

While this article assumes some knowledge of COBOL, anyone with a knowledge of BASIC will be able to follow the general discussion. If I omit an area of concern to you, take a look at the IBM COBOL manual before you assume it's not implemented. For the technically inclined, IBM COBOL conforms to the "Low-Intermediate" level of the American National Standard X.3.23-1974, providing nine of the 12 modules, and includes all of Level 1 and much of Level 2. I stress that the phrase "Low-

Intermediate" can be very misleading. This COBOL has plenty of punch.

There is little cause for concern about the absence of some of the ANSI standard modules from IBM COBOL. Although the Report Writer is not included, many programmers prefer to write report programs from scratch because they find the Report Writer too clumsy. And the special language for tape handling is not required.

IBM COBOL for the Personal Computer is a major and important product. COBOL is the dominant language for business use and will continue to be in the foreseeable future. Successful corporations, which can and do buy the best tools available, use COBOL extensively. One of the reasons COBOL remains dominant is that you can do substantial work in a relatively short time—it's a productive language. And with COBOL a single programmer has the same productivity aids as large corporations with platoons of programmers.

State of the Art Files

Perhaps the most important difference between BASIC and IBM COBOL is how this COBOL handles files. IBM COBOL offers the most sophisticated technique for indexed files based on "prefixed B-trees," meaning that all records are stored in disk files in sorted order. The specific order is determined by the field in the record, which you select as the record key. This extremely complex housekeeping is performed automatically. Response times for record storage and retrieval are excellent. The index file system is true state of the art software.

For each indexed file you set up in IBM COBOL two disk files are generated. The first is named by you, but the second file is automatically created and carries system information for dealing with your records. This second file is given the file name you select with the extension .KEY appended by the system. Tedious file index sorts can be a thing of the past. And the programs to perform these file index sorts don't have to be written—not a trivial task on some systems.

You can access indexed file records three different ways: randomly, sequentially, and dynamically. The random mode permits access by key to any record in the file regardless of location. The sequential method permits access by ascending key. The dynamic mode permits you to alternate between random and sequential. The dynamic mode is most useful for locating a specific record by key and then processing the remaining records in the file sequentially from that specific record.

One feature we found that eased our programming task was the automatic computation of the file record size. You aren't forced to count bytes in a record to determine its exact length.

Tedious file index sorts can be a thing of the past.

IBM COBOL has not implemented the Sort/Merge module from the ANSI standard. However, with the indexed file system provided with IBM COBOL, sorting records into different sequences based on different keys was straightforward. You can simply use the COBOL STRING statement to build your new key and then write the record to an indexed file. Your records are automatically sorted by the system as they are written to the file. I have used the Sort/Merge module in another COBOL compiler, but I discovered the code was more understandable using IBM COBOL's indexed files.

The records produced by using the indexed file system of IBM COBOL do include system information. While I have not examined any files, the manual states that the first 3 bytes of each record consist of a 2-byte length field followed by a 1-byte reference count. Indexed files themselves are also terminated by a short system-maintained field. Since I also use BASIC to perform some manipulation of data in COBOL files, I elected not to fight the battle of byte-fiddling to remove or ignore these system fields in the COBOL records. Instead, I rewrote the files using COBOL's LINE SEQUENTIAL technique, which writes a disk file in exactly the same format as the line editor, EDLIN, and it safely removed all the system information from my records.

IBM COBOL indexed files have several limits. The record key must be alphanumeric and length of the key cannot exceed 60 bytes. In practice neither limit was restrictive. Duplicate keys are not permitted.

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While certain applications require duplicate keys, they can create as many problems as they solve.

In addition to indexed files, IBM COBOL supports relative record files based on record numbers. The maximum record number is 32,767. And "straight" sequential file handling is supported in addition to a "line" sequential format. The difference between straight sequential and line sequential is that straight sequential processing maintains a 2-byte count of the record length in addition to the record itself, while line sequential outputs a record in the same format as the system editor, EDLIN.

Those not familiar with COBOL should be aware that COBOL provides facilities for automatic file error detection, all located in one place in your COBOL program. Unlike with Pascal, you are not required to test for file errors by calling a special error-handling routine each time you access a file. The technique is roughly analogous to BASIC's ON ERROR statement but much easier to use. These improved file error-detection and recovery techniques are fully implemented in IBM COBOL.

Screen Formats

I cannot praise IBM COBOL's screen formatting highly enough. With a screen format, you can describe the appearance of the entire screen to the user. And these screen formats take full advantage of the Personal Computer's advanced features such as function key detection. One of the reasons users have not seen more help screens in older software is that they were tedious to write. IBM COBOL makes help screens realistic because they are easy to implement.

To use full-screen formatting, IBM COBOL has implemented a special section in the Data Division of the COBOL program called the Screen Section. Since there are more than 20 screen options permitted for each screen field, a code fragment will help.

```
01  SETUP-SCREEN.
    05  BLANK SCREEN.
    05  LINE PLUS 2 COLUMN 34 "Chart of
        Accounts"
    05  LINE PLUS 2 "Account Number:".
    05  COLUMN 20 PIC X(6) FROM ACCOUNT-NUMBER.
    05  LINE PLUS 1 "Account Name :".
    05  COLUMN 20 PIC X(32) FROM ACCOUNT-NAME.
    05  LINE PLUS 1 "Account Total:".
    05  COLUMN 20 PIC $9(7)V99 FROM ACCOUNT-
        TOTAL.
```

The group level name is the screen name, and the entire screen can be displayed by a single statement, DISPLAY SETUP-SCREEN. The BLANK SCREEN causes the entire display to be erased and the cursor is placed in the home position at row 1, column 1. Then "Chart of Accounts" would be placed on row 3, starting at column 34. On row 4 at column 1 (the default since no column was specified) "Account Name :" is displayed. The FROM ACCOUNT-NUMBER phrase will cause the current value contained in ACCOUNT-NUMBER to be displayed at column 20 in the format specified by the PIC statement. The value of ACCOUNT-NUMBER would presumably be a default field, which could be the last-entered account number incremented by 1 else-

WITH COBOL a single programmer has the same productivity aids as large corporations with platoons of programmers.

For The Connoisseur

Important aspects of COBOL that may be of interest to the experienced COBOL programmer.

IBM COBOL includes:

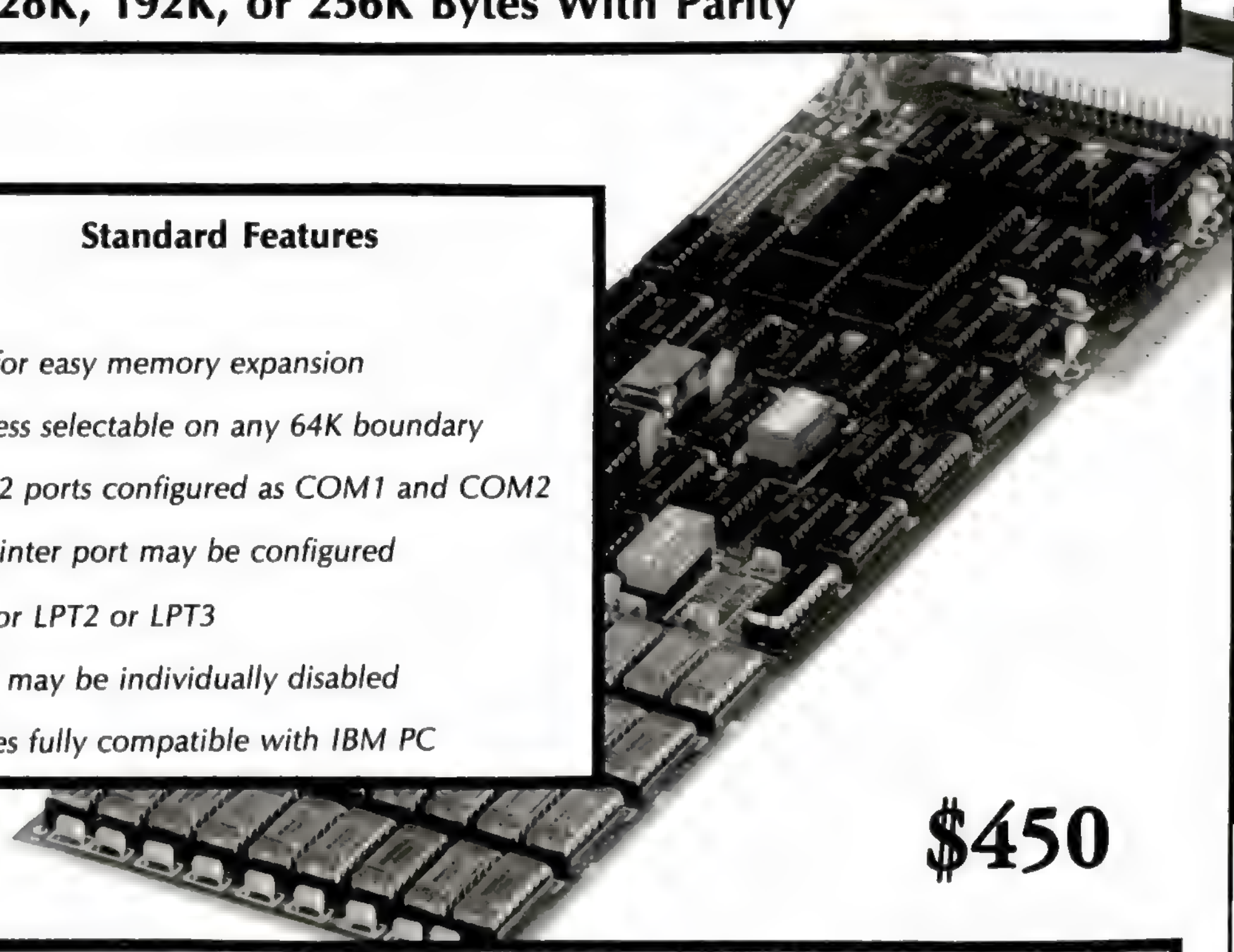
- Variable names up to 30 characters.
- A full LINAGE clause for printer paging control, including FOOTING AT.
- Printer controls with BEFORE or AFTER ADVANCING either LINE or PAGE, including the important END-OF-PAGE test.
- ADVANCING optionally may take any value between 0 and 120 lines.
- Table handling includes both subscripts and indexes with relative indexing supported. For example: TAX-TABLE (I + 3, J - 1).
- Table searching may be linear or binary, with ASCENDING or DESCENDING KEY together with the AT END exit option.
- Complex relational tests are possible, such as:
 IF A = 1 AND B = 2 AND G > 3
 OR P IS NOT EQUAL TO "SPAIN".
- Up to 14 files in a run unit, which is the main program linked to any subprograms.
- Indexed files support the START statement with key relations EQUAL, GREATER, NOT LESS.
- Sequential files may be expanded with the optional EXTEND statement.
- 18-digit precision.
- COMPUTATIONAL-3 support in addition to COMPUTATIONAL-0. COMP-3 packs two digits to the byte.
- A COPY statement to include source code from another file.
- The ALL constant for single character literal, LOW-VALUE, HIGH-VALUE, SPACE, and QUOTE.
- A TRACE statement to display procedure names as they are executed.
- DEBUGGING MODE and EXHIBIT are available; EXHIBIT can specify row and column location.
- I/O CONTROL to permit file buffer sharing.
- Run-time SWITCHes are available.
- FIPS flagging at compile time.

—J.H.C.

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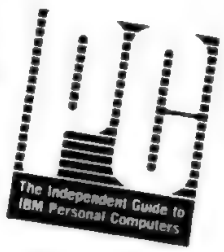
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where in the program.

Options are available to permit a field to be underlined, flashing, displayed in reverse-video, or displayed in your choice of colors on a color monitor. But the important and powerful ACCEPT statement is where this COBOL helps both the programmer and the user. The ACCEPT statement basically takes the user's input from the screen and places it in a program variable. The COBOL manual has 27 pages devoted to the ACCEPT statement so only a very general idea can be conveyed here. The ACCEPT statement can be viewed as a data editor customized to input specifications with words such as EMPTY-CHECK, which rejects an empty field, or LENGTH-CHECK, which cannot be terminated until all digit positions in a number have been entered. For password protection there is a NO-ECHO option and BEEP is useful to signal the user that the program is ready for input.

THE INDEX file system is true state of the art software.

The ACCEPT statement can be used in the above code example to get the input to ACCOUNT-TOTAL. You want the user to be informed of the length permitted for this field by writing zeros to both the right and left of the decimal point. If the previous value keyed would be acceptable, permit the user to press [ENTER]. One way this could be accomplished is:

```
ACCEPT (7, 20) ACCOUNT-TOTAL WITH PROMPT UPDATE.
```

What happens when the user accidentally enters a nonnumeric value? If you specify ACCOUNT-TOTAL as a numeric item, the keyed data will simply be rejected, or if you elect very tight field editing, you may set up the field with a different name and make it accept any input and test via a hand-coded validation routine to issue a very specific error message to the user's terminal. You have a choice in the degree of error checking you wish to have performed on any field. You can also accept an entire multifield screen with a single statement.

I was surprised at how fast user input could be accepted by these routines, including editing for duplicate keys and tight range checking. Heads-down data entry is realistic and function key detection is easy to use. A COBOL procedure to test if function key number 1 had been pressed might look like this:

```
CHECK-FUNCTION KEY.
    IF FUNCTION-KEY = '02' PERFORM HELP-
    SCREEN-1.
```

(Note that '01' is the escape key code and the remaining keys are '02' thru '11'.)

Chaining and Overlays

Full program chaining is supported; in fact, the chained program does not have to be a COBOL program. Overlays within main programs are supported by way of program segmentation so that programs larger than physical memory can be accommodated. Program calls may be issued to invoke other subprograms, including assembler subroutines. The manual details the method for parameter passing to subprograms, but I have not tested it because I believe that tightly coupled subprograms guarantee additional maintenance time when inevitable program changes occur.

Important Program Controls

Until you have written COBOL programs without them, you cannot begin to appreciate how important the logic operators AND, OR, and NOT can be to controlling program flow. IBM COBOL has them along with Level 88 condition names. These are important for readable code. To those who haven't used COBOL, "Level 88 condition names" must be the most nondistinctive term to have come out of a standards committee meeting. A Level 88 name is nothing more than a substitute for a condition you wish to test; it permits you to rename things by assigning them a value. For example, instead of writing:

```
IF PAYROLL-PERIOD = 3 PERFORM MONTHLY-PAYROLL.
```

You could write a more generalized statement with MONTHLY set up as a value of 3 and use:

```
IF MONTHLY PERFORM MONTHLY-PAYROLL
```

The Manual

The IBM COBOL manual states in the first paragraph of the Preface that it is not designed to teach you how to program in COBOL. Believe it. This is strictly a technical reference—a solid one. Examples are clear and helpful and the index is complete. It is the best compiler manual of those in the IBM language series for the Personal Computer. My only suggestion for the next edition of the IBM COBOL manual is to include additional examples of full-screen formatting since screen formats are not a standard COBOL module covered in other texts.

One difficulty for beginners lies in COBOL's origin on punch-card machines; many introductory texts reflect this anachronism. Beginners should look at Mike Murach's series on COBOL programming and beware of texts in which every other page looks like a pencilled-in punch card. Murach can write English as well as COBOL. You can obtain a list of titles and prices from Mike Murach & Associates, Inc., 4222 W. Almos, #101, Fresno, CA 93711.

The IBM COBOL Compiler

I use an IBM Personal Computer equipped with 256K of memory and a 5-megabyte hard disk that operates under DOS 1.10. The new 320K diskettes offer promising opportunities for IBM COBOL applications, not only because they have greater storage capacity but because they operate significantly faster.

Most early COBOL compilers were extremely slow, and COBOL compilers that produce efficient code are very difficult to write. This compiler is not slow although it uses four overlays during compilation. The compilation time is faster than IBM Pascal but slower than compiled IBM BASIC. It produces run-time code of reasonable size, considerably smaller than IBM Pascal, because COBOL uses a run-time package.

YOU AREN'T forced to count bytes in a record to determine its exact length.

The perfect compiler would probably run slower than cold molasses; apparently in the trade-off for speed the compiler does not perform elaborate error checking on screen formats. I encountered only one

area in which the compiler would not issue an appropriate error message. This area appeared to involve improperly constructed screen formats. Occasionally a faulty screen format passed the compiler without an error message only to have the final program crash, also without benefit of an error message. This instance was rare and any reasonably constructed screen format performed correctly. If you enjoy arabesque screen designs, you might want to curb this tendency at first.

The COBOL compiler, run-time package, two COBOL subroutine libraries, and the linker come on two single-density diskettes. The minimum memory required for COBOL compilation is 64K. While an 80-column display is recommended, you can use either the IBM PC Monochrome Display, a monitor, or a TV with an RF modulator. Communications via the IBM Asynchronous Communications Adapter is accessible directly from COBOL, however protocols must be handled by the user's program.

The Run-Time Package

The run-time package will identify the precise line number at which an error occurs plus an English error message, meaning you will save debugging time if you use an editor that permits you to go directly to any line number. We used the EDIX editor (which has this capability) for thousands of lines of source code, and it performed flawlessly.

With an editor like EDIX, you can turn off the compiler switch, which generates a listing of your source code with line numbers, and save time during compiles. The source listing with line numbers isn't usable unless you print a copy, so the time saved adds up rapidly during testing. We found EDIX split screens and simultaneous editing of multiple files a real help in writing COBOL source code.

The run-time package requires about 32K of memory in addition to that required by the applications program. This appears to be "smart software" and remains resident so that COBOL programs chain significantly faster than in noncompiled BASIC. The run-time package is a licensed product as is the BASIC compiler run-time module. Applications programmers wishing to distribute this run-time package must first enter into a license agreement with IBM.

Using a switch at compile time, you can disable the internal line numbering used by the run-time mechanism to determine the line at which an error occurred. This will shrink the size of the final code about 16 percent. I have tested this but don't use it. If you have ever tried to diagnose a run-time error long-distance, you probably won't use it either.

Cost

In what I consider the finest single book on programming, *Algorithms + Data Structures = Programs*, (Prentice-Hall, 1976), Niklaus Wirth states that while computers were intended to speed up time-consuming computations, the dominant applications are to store and retrieve large amounts of information, and that its ability to compute has in many cases become almost irrelevant. For this reason, COBOL will continue to be the most widely used language. IBM COBOL is very well suited for applications that handle data in volume. The implementation is a large subset of the full COBOL, including many features not covered here.

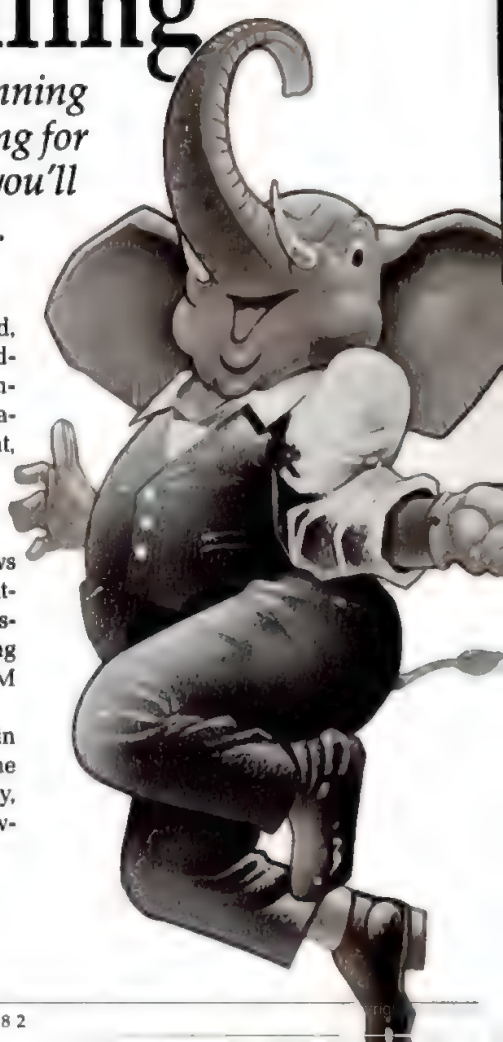
Many personal computer users are not aware of what a comparable compiler on a minicompuer would cost and what a real value this COBOL represents in terms of the function provided. To purchase COBOL with the same level of function on a minicomputer, $3,000 to $5,000 would be a reasonable range. At $800 IBM COBOL for the Personal Computer is a bargain.

It has elevated the personal computer to professional status. I predict you will see lots of business software written in IBM COBOL. **/PC**

SOFTWARE/PETER ROWLEY

PC Profiling

If your programs are running rather slowly and you long for optimum performance, you'll find profiling a pleasure.



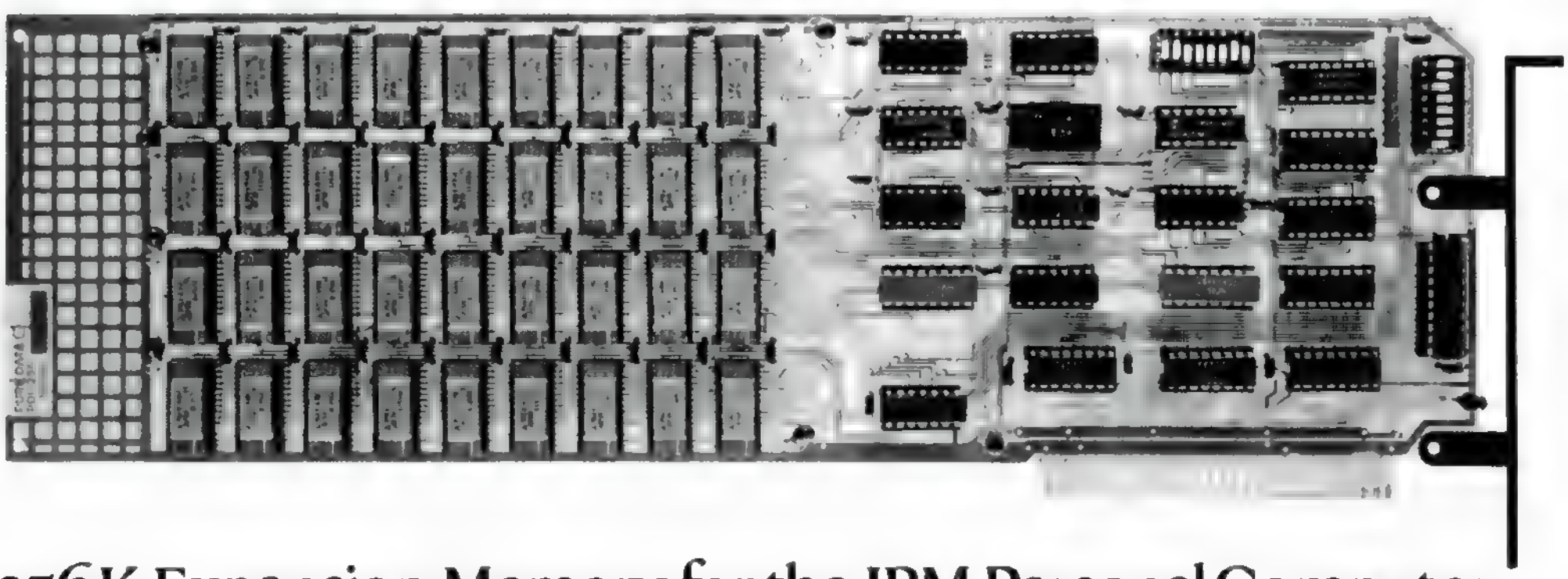
After programs are written and debugged, programmers often spend their time adding "bells and whistles" and trying to improve performance. For some applications, especially where speed is important, programs are not usable until they run at peak efficiency. One aid for these chores is a program profile.

A profile is a table or graph that shows how much time a program spends executing each part of its code. This article discusses profiling and presents a profiling package for Microsoft BASIC on the IBM PC.

Imagine a computer that runs BASIC in such a way that each statement takes the same amount of time to execute—say, 1/100 of a second. Then look at the following program:

```
10 FOR I=1 TO 100
20   A=A+5:B=B-1
30 NEXT I
40 A=A*10
```

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Here is the program's profile.

Line Number	Execution Time
10	100*.01 = 1 second
20	2*100*.01 = 2 seconds
30	100*.01 = 1 second
40	1*.01 = .01 second

The above assumes that the FOR and NEXT statements are executed each time through the loop. In this case it is easy to see where the program spends its time, even without using a profiler. Other situations are not so easy, especially where program activity depends on input from a file, keyboard, or communications line, and where statements execute in different amounts of time.

Profiling a program aids optimization and traces down strange bugs. If you know which parts of code a program spends most of its time executing, you can concentrate your efforts there, knowing that any improvements you make will increase the program's overall speed substantially. For example, if a program spends half its time executing one BASIC line and you speed up that line by a factor of two, the program will run 25 percent faster. Spending the same effort on a line on which the program spends only 10 percent of its time results in only a 5 percent improvement.

Occasionally, knowing where a program spends an inordinate amount of time can help in tracking down program bugs. Set breakpoints there or print the values of key variables to find the bug.

THE demonstration program reads the profile results and displays them as a bar graph.

A program itself does not have a profile. A profile is associated with a particular run of a program, on a particular machine, with a particular language processor, and with specific input data. This point is easy to understand. Imagine that the program shown earlier is changed to have the user input a value for N, and line 10 is changed to "FOR I=1 TO N." The profile table will change on each run, depending on what value the user enters. If you move the program from a computer that does ADD instructions faster than MOVE instructions to a computer that prefers MOVEs, the portions of the program that use ADDs will speed up in relation to portions that use MOVEs, resulting in a different profile. Finally, moving from a BASIC interpreter written by one company to one written by another will cause some statements to execute faster or slower than before.

Profilers need not be complicated. The profiler presented here occupies just over 200 bytes of memory and consists of only four routines. It is designed to be called from BASIC and provides only the raw data. You may write a program in BASIC to change the raw data into whatever format you desire; graphics will be very useful for this. At the other end of the spectrum, detailed analysis can be

Figure 1. BASIC Program to Build Profiler

```
10    ' BASIC program to build Profiler
20    ' By Steven Cook 9-SEP-82
30    '
40    ON ERROR GOTO 500
50    CLS:KEY OFF:WIDTH 40:SCREEN 0,0,0
60    LOCATE 24,1:PRINT ''PROFILER CREATION PROGRAM''
70    PRINT:PRINT ''Verifying data. One moment. please...''
80    FOR L=1 TO 14
90       TOTAL=0
100      FOR I=1 TO 16
110         READ VALUE:TOTAL=TOTAL+VALUE
120      NEXT
130      READ CKSUM:IF CKSUM<>TOTAL THEN 490
140   NEXT
150   PRINT ''Data OK. Building memory image...''
160   DEF SEG=&HC00:ADDR=0
170   RESTORE
180   FOR L=1 TO 14
190      FOR I=1 TO 16
200         READ VALUE
210         POKE ADDR,VALUE
220         ADDR=ADDR+1
230      NEXT
240      READ CKSUM 'read and ignore
250   NEXT
260   PRINT ''Image in memory. Prepare for disk save.''
270   PRINT:PRINT ''Insert formatted disk in drive A''
280   PRINT ''Press SPACE to continue. ESC to abort''
290   A$=INKEY$:IF A$="" THEN 290
300   IF A$=CHR$(27) THEN 510 'escape key?
310   IF A$<>CHR$(32) THEN BEEP:GOTO 290
320   BSAVE ''A:PROFILE.MEM'',0,&HDF
330   PRINT ''Process complete.''
340   GOTO 520
350   DATA 235,7,144,235,91,144,235,123,144,85,139,236,139,118,6,139,2220
360   DATA 12,65,6,30,14,31,190,209,0,43,210,43,219,137,28,139,1376
370   DATA 28,131,251,0,117,42,66,70,70,226,242,142,195,38,139,30,1787
380   DATA 112,0,137,30,92,0,38,139,30,114,0,137,30,94,0,250,1203
390   DATA 187,162,0,38,137,30,112,0,140,203,38,137,30,114,0,251,1579
400   DATA 31,7,139,118,6,74,137,20,93,202,2,0,0,0,0,0,829
410   DATA 85,139,236,6,30,14,31,43,219,142,195,250,139,30,92 0,1651
420   DATA 38,137,30,112,0,139,30,94,0,38,137,30,114,0,251,31,1181
430   DATA 7,93,203,85,139,236,139,118,6,139,4,64,30,14,31,3,1311
440   DATA 192,5,209,0,139,240,139,4,31,139,118,6,137,4,93,202,1658
450   DATA 2,0,131,236,4,30,83,43,219,142,219,139,30,16,5,142,1441
460   DATA 219,139,30,46,0,67,3,219,14,31,129,195,209,0,255,7,1563
470   DATA 131,196,8,255,54,94,0,255,54,92,0,131,236,4,91,31,1632
480   DATA 203,0,0,0,0,0,0,0,0,0,0,0,0,0,0,203
490   PRINT ''Incorrect data in DATA statement #'';L
500   PRINT ''Error: Correct program and rerun.''
510   BEEP:PRINT ''Program aborted''
520   END
```

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performed with hardware profilers that attach to the bus of the computer system being measured and gather data at the machine instruction level.

This profiler is simple because it works in a probabilistic manner and gives only approximate profiles. It can't tell exactly how much time a program spends on each statement. If I wanted to keep track of where you spend your time, I could follow you with a stopwatch, recording when you arrived at and left the places you frequent. How tedious! Instead I could position myself high above your town and look to see where you are every so often. If I know how often I look, how many times I've looked, and how many times I've seen you in the bank, I can approximate how much time you spent in the bank. For example, if I look every 5 minutes, have looked 20 times, and have seen you in the bank three times, I can guess you were in the bank for 15 minutes, 3/20 of the total time. The more often I look, the better approximation I can make. Note that if you go into the bank, leave, and return, I will take this time all together. This kind of approximation is fine for profiling.

PROFILERS deserve to be one of the standard tools provided with computer languages.

Technical Notes

The following profiler "looks" at the BASIC program 18.2 times a second. It counts observations using a 16-bit counter for each line of the BASIC program. This observation activity will slow the BASIC interpreter somewhat, but not by much. The "observer" code in the profiler is set up to be called by the PC's timer interrupt handler 18.2 times a second. Programs that also use the timer interrupts may still be profiled, but remember that when the observer is finished, it will pass control to whatever routine was executing before the interrupt occurred.

Figure 2. Profiler Demonstration Program

```
10    ' Profiler demonstration program
20    ' by Steven Cook 8-SEP-82
30    DEF SEG=&HC00:BLOAD ''PROFILE.MEM'',0
40    STARTP%=0:ENDP%=3:GETP%=6
50    MAXLINE%=140:CALL STARTP%(MAXLINE%)
60    ' dummy program for profile demonstration
70    FOR LOOP=1 TO 24
80       X=0:R=RND*1000
90       PRINT R,
100      X=X+1
110      R=R/2
120      IF R>1 THEN 100
130      PRINT X
140   NEXT
150   CALL ENDP%
160   ' following section produces a graph
170   CLS:WID%=80 'screen width
180   FOR L%=10 TO MAXLINE% STEP 10
190      PRINT USING ''###'':L%;
200      N%=L%:CALL GETP%(N%)
210      IF N%>WID%-5 THEN N%=WID%-5
220      FOR I=1 TO N%
230            PRINT ''-'';
240      NEXT
250      PRINT
260   NEXT
270   END
```

To make the profiler usable for as many readers as possible, it is published here as a BASIC program that builds the profiler in memory and then stores it on a disk.

To use the profiler you must create a file that contains the profiler and can be BLOADed into memory by BASIC. The easiest way to create the file is to copy it from a friend's disk. If you can't find a copy already on disk, you must key in the program shown in Figure 1. This program will create the profiler in memory and then save it on disk. Type the program exactly as it is printed, then save it on disk before you run it. The program will check itself for errors and inform you if any are detected.

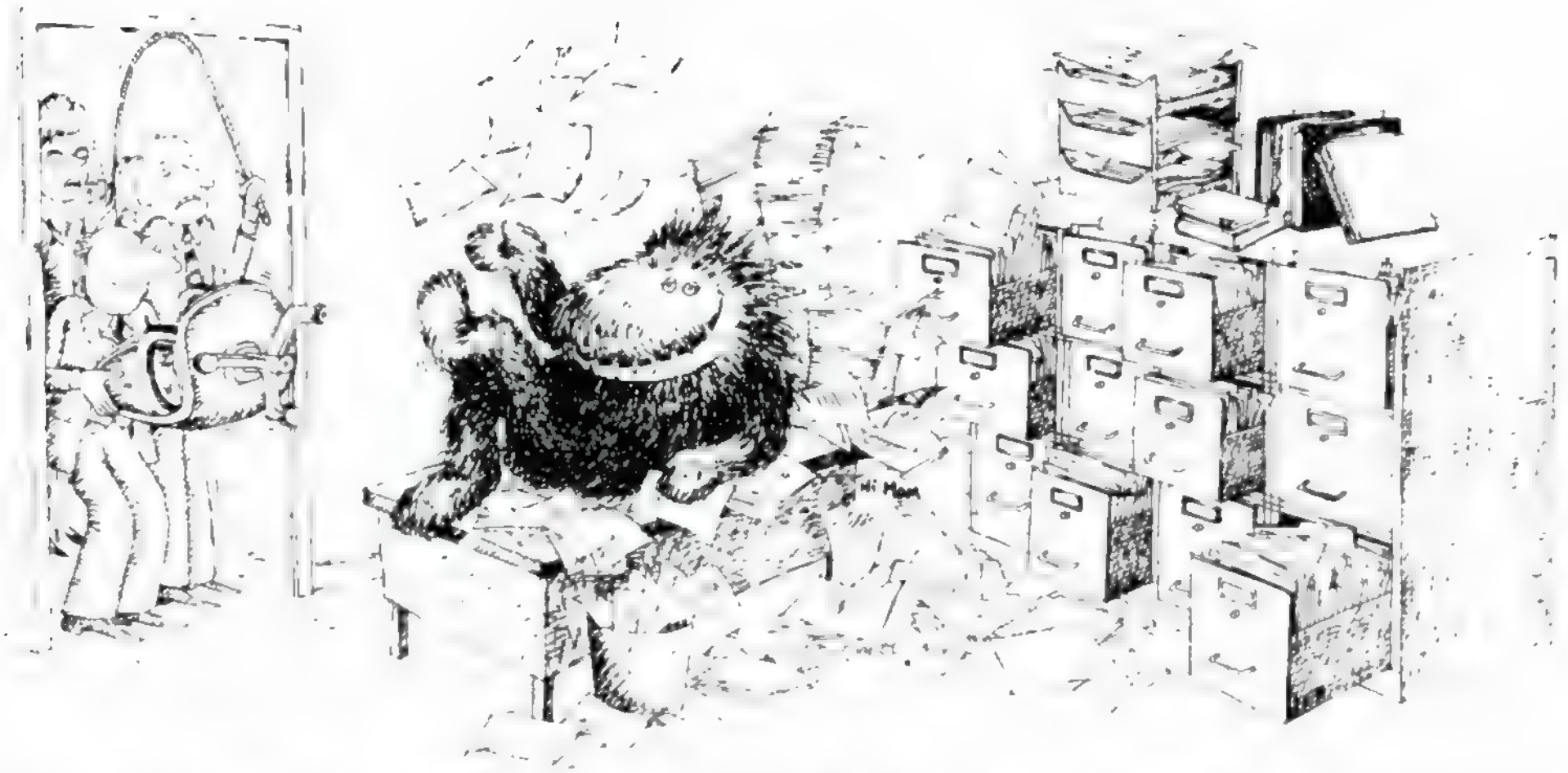
Using the Profiler

After you have the profiler on disk, type in and run the demonstration program in Figure 2. The demonstration program will generate and divide several random numbers and display a graph of its profile. The statements in line 30 define an area of memory where the profiler will reside, then load the profiler into memory from the disk. Line 40 defines three entry points into the profiler: start, end, and get. These are equivalent to line numbers for GOSUB statements in BASIC. The CALL statement in line 50 starts the profiler running. From this point the profiler will observe the execution of the BASIC program until the profiler's end routine is CALLed in line 150.

The next section of the demonstration program reads the profile results and displays them as a bar graph. The CALL statement in line 200 passes a line number to the profiler, and the profiler returns the number of times it observed that line executing. If you have a color/graphics adapter, you may wish to display results using the advanced graphics capabilities of the PC.

Profilers can be made for all languages on most machines, either in hardware or with software and some minimal hardware to provide a periodic interrupt. Profile results can be indispensable during program development, turning optimization from an art into a science. Now that personal computers are powerful enough to support them, profilers deserve to be one of the standard tools provided with computer languages. **/PC**

If you have the IBM Macro Assembler and would like to receive the assembly language listing of the profiler, send a self-addressed, stamped envelope to PC Profiler, *1528 Irving St., San Francisco, CA 94122.*



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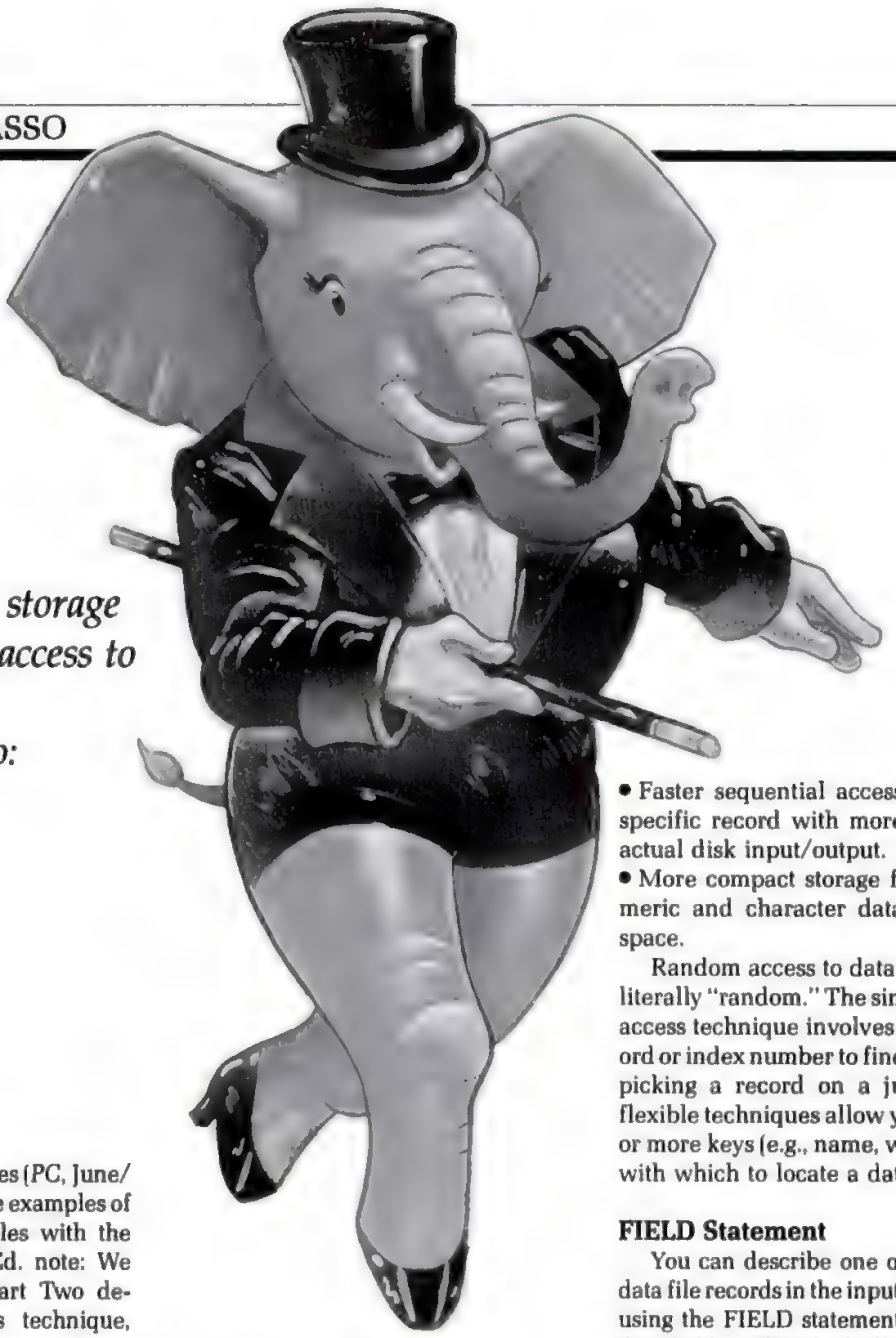
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Using Data Files

Economical use of storage space and speedy access to data files with BASIC—Part Two: Random Access.



Part One of this two-part series (PC, June/July, 1982) described and gave examples of sequential access to data files with the IBM Personal Computer. (Ed. note: We apologize for the delay.) Part Two describes the random access technique, which provides direct data access and conserves storage space. These articles do not teach BASIC programming; you must be familiar with the BASIC programming language on the PC to understand the examples presented.

The sequential access method has the following characteristics:

- The INPUT#, PRINT#, and WRITE# statements used for sequential access are easy to use and the data storage format is easy to understand.
- The INPUT#, PRINT#, and WRITE# statements do not actually perform input from or output to the disk. In fact, you cannot control actual disk input/output from your program using sequential access. Instead, the statements move data into a buffer, controlled by Disk BASIC, which performs the actual input/output.
- Sequential access does not allow direct access. To change data in a file using sequential access, you must read and write the entire file.
- In the sequential writing method data is stored as ASCII characters including spaces and punctuation symbols, which occupy disk space.

Random access techniques have several desirable characteristics for managing a data base:

- Direct access to a specific record by an index number for the record.
- Keyed access to a specific record by specifying one or more keys to the record (key file accessed sequentially or using hashing techniques).
- Faster sequential access starting at a specific record with more control over actual disk input/output.
- More compact storage format for numeric and character data, saving disk space.

Random access to data records is not literally "random." The simplest random access technique involves picking a record or index number to find a record, like picking a record on a jukebox. More flexible techniques allow you to pick one or more keys (e.g., name, word, zip code) with which to locate a data record.

FIELD Statement

You can describe one or more logical data file records in the input/output buffer using the FIELD statement to define the data fields within the buffer. These fields can contain regular alphanumeric strings (as with sequential access), and they can also contain numbers converted into string storage format with the MKI$, MKS$, and MKD$ functions.

With the FIELD statement you name variables for fields organized in the buffer. These variables, or "pseudo-strings," are stored in the buffer and are assigned values by using the LSET and RSET statements. These are used like LET statements, but they also provide the ability to right justify (RSET) or left justify (LSET) the data within the field.

You specify a particular file's buffer size in the OPEN statement for that file with the "reclen" parameter. BASIC manages the transfer of data between the buf-

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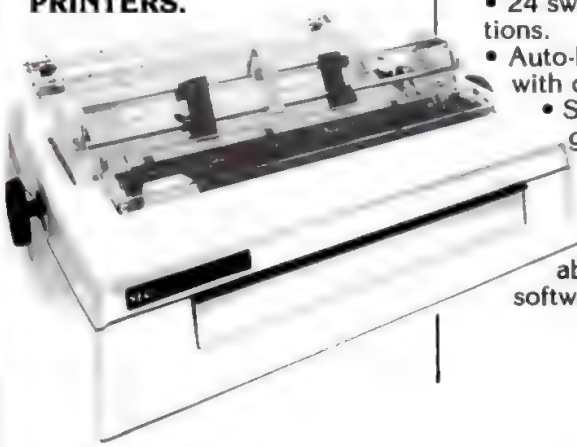
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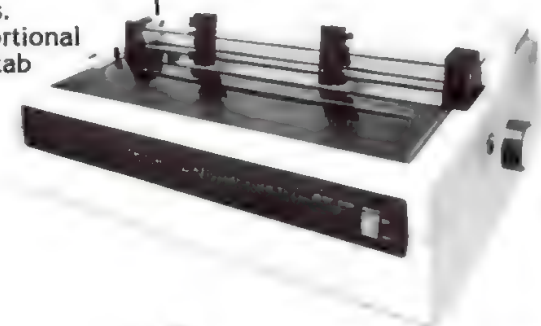
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fer and the disk, but you can improve efficiency by having your program manage data storage in the buffer by using FIELD statements.

FIELD variables can be respecified at will, even when executing the program. Multiple FIELD statements let you map the same buffer contents with different variable names for use in your program.

Figure 1 demonstrates how multiple FIELD statements can define alternate names for the same data in the buffer. The NAME$ variable can be used in statements 100 and 110 without confusion, because it describes the same space in the buffer. The trio of FIELD statements in Figure 1 allows access to the fields within a customer data record and to large collections of the same fields.

YOU CANNOT control actual disk input/output from your program using sequential access.

Figure 1: Overlapping FIELD Names in the Same Buffer

```
100  FIELD 1, 20 AS NAME$, 20 AS STREET$, 20 AS
     CITY$, 2 AS STATE$, 5 AS ZIP$
110  FIELD 1, 20 AS NAME$, 47 AS ADDRESS$
120  FIELD 1, 67 AS CUSTOMER$
```

Figure 2: Simple Indexed File

```
     [LINE 10 DELETED]
20   REM ACCUMULATED DAYS PER MONTH
30   DATA 0,31,28,31,
     30,31,30,31,31,30,31,30
40   DEFINT A-Z
50   DIM M(12)
60   FOR I = 1 TO 12
70      READ M(I)
80   NEXT
90   OPEN ''R'' 1,''BUSSUMRY DAT'',512
100  FIELD 1, 4 AS CASHRCT$, 4 AS PURCH$, 4 AS
     WAGES$,.  etc.
110  INPUT ''DATE'';D$ 'FORMAT MM/DD/YY
120  JM = 10*VAL(MID$(D$,1,1))+VAL
     (MID$(D$,2,1))
130  JD = 0
140  FOR I = 1 TO JM
150     JD = JD + M(I)'DAYS IN PREVIOUS
160  NEXT', MONTHS
170  JD = JD + 10*VAL(MID$(D$,4,1))+VAL
     (MID$(D$,5,1))
180  GET 1,JD
190  CA = CVS(CASHRCT$)
```

Figure 3: Packing 64-Byte Logical Records into a Sector

```
     'PROCESS DATA

50   DIM M(12), CASHRCT$(8), PURCH$(8),
     WAGES$(8), ...

100  FOR I = 0 TO 7
102       FIELD 1, (I*64) AS SKIP$, 4 AS
            CASHRCT$(I), 4 AS PURCH$(I),
              4 AS WAGES$(I), ... etc.
104  NEXT

180  GET 1,INT((JD-1)/8)+1
190  CA = CVS(CASHRCT$(JD-INT((JD-1)/
     8)*8+1))
```

Figure 4: Access by Key

```
     [LINE 10 DELETED]
20   DEFINT A-Z: DIM KEY$(32),NAME$(32)
30   INPUT''ENTER FILESPEC'':A$
40   OPEN ''R'',1,A$,512
50   FIELD 1, 20 AS STREET$, 20 AS
     CITY$,...etc. (ASSUME 512 BYTE RECORD)
60   B$ = A$     'USE EXTENSION''.KEY''
70   FOR I = 1 TO LEN(A$)
        IF MID$(A$,I,1) = ''.'' THEN
           B$ = LEFT$(A$,I-1)
```

Continues

Pseudo-String Variables

BASIC insists on performing input/output with strings, but it also provides a mechanism for treating numbers as strings. The MKI$, MKS$, and MKD$ functions allow BASIC to pretend that integers, single-precision numbers, and double-precision numbers are strings.

MKS$(4.235), for example, tells BASIC to pretend that the 4-byte single-precision number 4.235 is a 4-byte string. This allows numeric data to be stored in 2-byte, 4-byte, or 8-byte pseudo-string variables in the buffer, occupying less disk space than with the sequential storage method.

To retrieve numbers from the pseudo-string variables in the buffer, use the CVI, CVS, or CVD functions (for integers, single-precision numbers, and double-precision numbers respectively). These functions do not actually change or convert bytes; they simply remind BASIC that these values were once numbers and should be treated as numbers.

The pseudo-string variables are not real variables and cannot be used on the left side of the equals sign in a LET statement. Real string variables are allocated space in a reserved area of BASIC's available working memory, and BASIC manages these variables on the fly during program execution. FIELD "pseudo-string" variables are treated as strings for assignment and functional processing, but they reside in the buffer space assigned to them by the FIELD statement. If a FIELD variable is used on the left side of the equals sign in a LET statement or command (e.g., "LET C$=" or C$="), it ceases to be a FIELD variable.

Indexed Access

GET and PUT statements control the actual input/output operations of transferring data between the buffer and physical disk sectors. The buffer size is 256 bytes by default; however, physical disk sectors are 512 bytes long. Input/output operations are more efficient if you change the buffer size to 512 bytes by using the "S" option when executing the BASIC command.

Both GET and PUT use record numbers to find sectors on the disk. If you do not include a record number in a GET or PUT statement, the statement accesses the next sequential record. For example, using GET to find a specific record, you can then use a series of GET statements to access the next sequential records in the file.

DOS allocates disk space automatically. When a PUT is executed and all currently allocated space has been used, DOS will allocate additional space if it is available on the disk.

Two functions—EOF and LOF—are useful when performing random access techniques. The EOF function returns a logical TRUE value when BASIC detects the end of a file, while the LOF function returns the number of the last record in the file.

With the indexed access methods a rec-

ord is accessed by specifying its number. This is a simple method for applications in which record numbers are easy to use. For more complicated data base applications, use keyed access.

Assuming you have a file containing the daily summaries of the transactions of a typical business (see Figure 2) and that each day's summary data can fit into a 512-byte record, you can use a single record for each day. You can use the date to calculate the record number and use the record number as an index number.

Look at the FIELD statement in line 100 of Figure 2. How would you structure the FIELD statement if the daily summaries were only 64 bytes long and you wanted to fit several 64-byte logical records into one physical 512-byte record the size of the entire buffer? And how would you access individual records?

Figure 3 shows how to modify the program to define shorter logical records and how to calculate the logical record index within the physical records using the physical record number in variable JD (line 180).

Keyed Access

Most data base applications are too complicated for indexing access with record numbers. To design a proper data base, you must define a type of key that can uniquely identify specific records, and you must provide a way to locate the data record using the key.

Consider one of the easiest methods of keyed access: a data file of customer information using a parallel key file of last names. Each record in the data file has a corresponding entry in the key file. The program searches the key file for last names, and when it finds the required last name, it uses the key record number to point to the desired data record.

By searching only the key file you save processing time, because the key record is much shorter than the data record. In Figure 4, because the key length is 1/32 the length of the data, searching is done at a speed approximately 32 times faster than searching the data file.

Figure 4 uses a separate key file to contain the key records, but some designers prefer to store key data at the beginning or end of the data file itself. Note that since the key field NAME$ is kept in the key file, it is not necessary to duplicate it in the data file records.

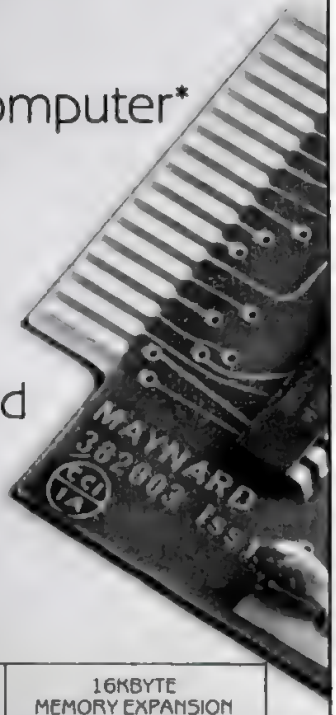
```
90   NEXT
100  B$ = B$ + ".KEY"
110  OPEN "R",2,B$
120  FOR I = 0 TO 31 'PACK KEYS 32 PER RECORD
130      FIELD 2, (16*I) AS SKIP$, 16 AS KEY$(I)
140      FIELD 2, (16*I) AS SKIP$, 16 AS NAME$(I)
150  NEXT
160  CLS:PRINT"SELECT FUNCTION":PRINT
170  PRINT"1 - BUILD FILE"
180  PRINT"2 - ACCESS FILE"
190  PRINT"3 - QUIT"
200  INPUT"";I
210  IF I < 1 OR I > 3 THEN 160
220  IN I GOSUB 400,600,800
230  GOTO 160
390  REM BUILD DATA FILE AND KEY FILE
400  I=0
410  INPUT"NAME OR <QUIT>";N$
420  IF N$ = "QUIT" THEN
         PUT 2:
         RETURN
430  LSET KEY$(I) = N$
440  I = I + 1
450  IF I = 32 THEN      'TEST KEY BUFFER FULL
       I = 0:
       PUT 2
460  INPUT"STREET";S$     'FILL REST OF DATA
       BUFFER
470  LSET STREET$ =S$
480  .
                          'PROCESS REST OF FIELDS
     .
     .
570  PUT 1
580  GOTO 410
590  REM ACCESS FILE RECORD BY KEY
600  INPUT"ENTER KEY";N$
610  IF N$ = "QUIT" THEN RETURN
620  L = 1
630  FOR I = 1 TO LOF(2)
640      GET 2,I
650      FOR J = 0 TO 31
660          IF LEFT$(KEY$(J),LEN$(N$))
             = N$ THEN
             GOTO 710 'KEY FOUND - READ DATA
670          L = L + 1
680      NEXT
690  NEXT
700  PRINT"KEY NOT IN FILE":GOTO 600
710  GET 1,L
     .
                                  'PROCESS DATA
     .
790  GOTO 600
800  CLOSE 1,2
810  END
```

Figure 5: Access by Hashing the Key

```
     [LINE 10 DELETED]
20   DEFINT A-Z
30   INPUT"ENTER FILESPEC":A$
40   OPEN "R",1,A$,512
50   FIELD 1, 16 AS NAME$, 20 AS STREET$, 20 AS
     CITY$, ... etc.
60   CLS:PRINT"SELECT FUNCTION":PRINT
70   PRINT"1 - BUILD FILE"
80   PRINT"2 - ACCESS FILE"
90   PRINT"3 - QUIT"
100  INPUT"";I
110  IF I<1 OR I>3 THEN 60
120  ON I GOSUB 400,600,800
130  GOTO 60
390  REM INITIALIZE AND BUILD FILE
400  CLS:INPUT"ENTER MAXIMUM NUMBER OF
       RECORDS IN FILE":I
410  LSET NAME$ = STRING$(16," ")
420  FOR J = 1 TO I     'SET NAME$ TO BLANKS
       (NO DATA)
430      PUT 1,J
440  NEXT
450  CLS:INPUT"NAME":N$
460  IF N$ = "QUIT" THEN
         RETURN
470  GOSUB 1000     'CALCULATE HASH CODE
480  GET 1,HA
490  IF NAME$ <> STRING$(16," ") THEN
                              'TEST RECORD USED
           HA = HA+1     'GET NEXT RECORD
     GOTO 480
500  LSET NAME$ = N$
510  INPUT"STREET";S$
520  LSET STREET$ = S$
                    'FILL IN REST OF DATA RECORD
     .
     .
570  PUT 1,HA
580  GOTO 450
590  REM ACCESS RECORD
600  CLS:INPUT"ENTER KEY (NAME)":N$
610  GOSUB 1000     'CALCULATE HASH CODE
620  GET 1,HA
630  IF NAME$ = STRING$(16," ") THEN
                              'TEST UNUSED RECORD
       PRINT "RECORD NOT FOUND"
       GOTO 600
640  IF NAME$ <> N$ THEN
                'TEST OTHER NAM$ HASHES THE SAME
             HA = HA+1 'GET NEXT RECORD
       GOTO 620
650  REM RECORD FOUND - PROCESS IT
     .
     .
790  GOTO 600
800  CLOSE 1,2
810  END
990  REM HASH SUBROUTINE
1000 HA = 0
1010 FOR I = 1 TO LEN(N$)
1020     HA = (HA + HA + ASC
         (MID$(N$,I,1)))
         AND 255
1030 NEXT
1040 HA = HA + 1          'DO NOT ALLOW ZERO
1050 RETURN
```

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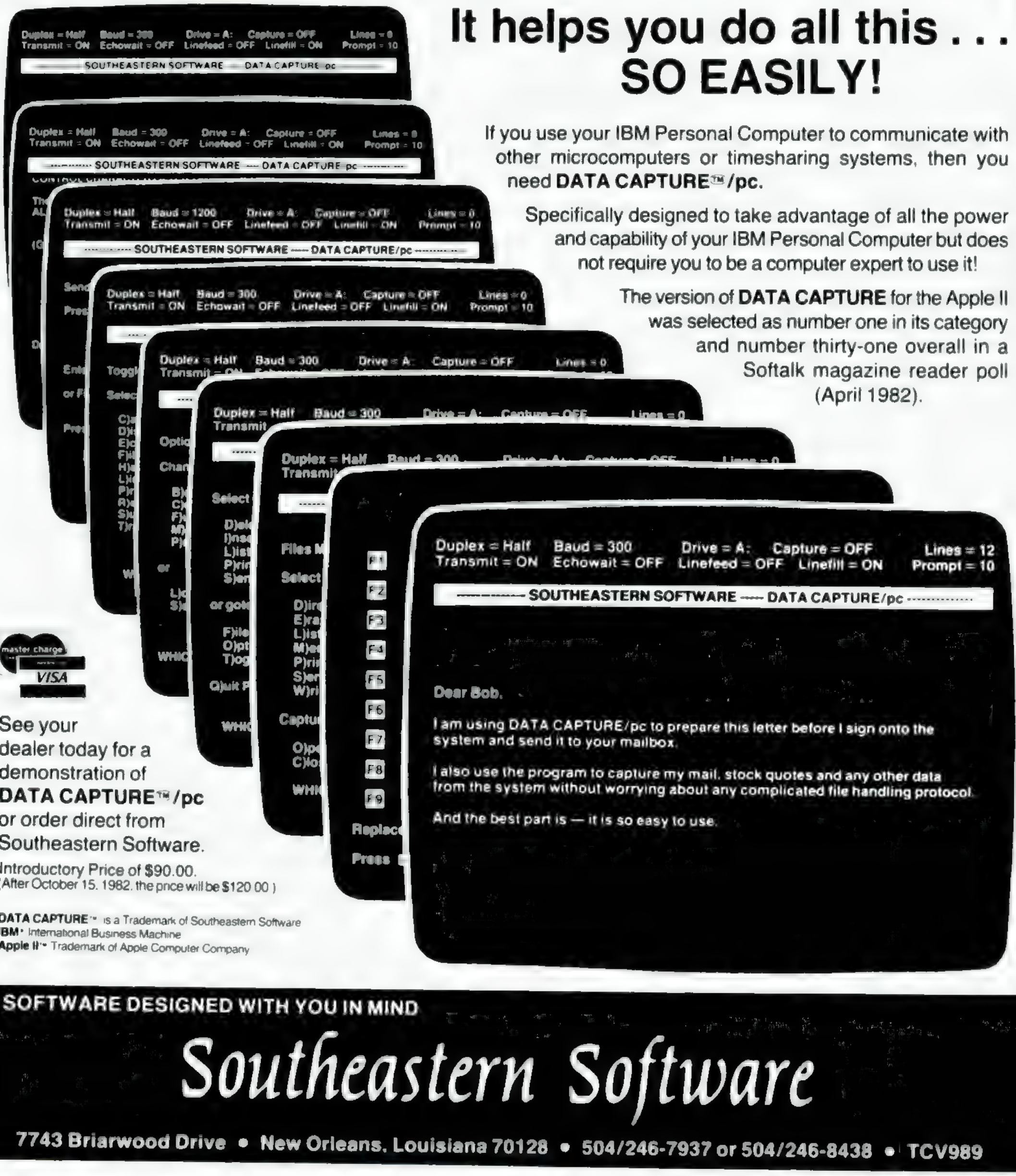
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By using multiple key files different keys can be used for different applications. Simply maintain a separate key file for each different key variable. For an application that requires sorted printouts of data records, you can maintain the key file in sorted order and add another field to each key record to contain the number of the associated data record. To print records in sorted order, your program would start at the first key in the sorted key file and use the record number variable stored with that key to find and print the associated data record.

Hashing Keys

Another approach to random access is the hashing method. This technique allows approximate calculation of the record number based on a key within the data and uses no separate key files. It involves calculating a hash code number from the key and using that code number as the starting point for a data search. A hash code is usually used as an index to a record; however, to be a good code it must be "one-way unique" and be evenly distributed for any possible key.

"One-way unique" means that a given key will always produce the same hash code, but that other keys may also produce the same hash code. Hash codes can be calculated in as many ways as there are people who have tried them. The magnitude of the hash code should be approximately the same as the maximum number of records in the file, and the hash code calculation should be quick.

The method used in Figure 5 doubles and sums each byte of data in the key and then converts the results to 1 byte. The doubling is done to encourage carry over into the high-order byte, thus flattening the distribution of hash codes.

The same customer file used in other figures is used in Figure 5 to illustrate the hashing method. The subroutine at line 1000 calculates a hash code between 1 and 256. This example requires an initialized file in which "empty" records are written before the file is filled with data.

Statements 480 to 490 search the data file for an empty record starting at the record number derived as a hash index. When the routine finds an empty record, it inserts a new one. In a similar manner, statements 620 to 640 search for the keyed record in the data file starting with the hash index. If the routine finds an empty record, it assumes an error occurred (probably in typing the key). A program such as the one in Figure 5 could add or delete records at times other than at initialization. You may want to add these functions.

If you have read Parts One and Two of this article, you should be able to write your own programs using data files and choose the right type of file for the task. You may wish to experiment until you feel confident enough to tackle a large programming project. Another useful learning aid is studying other programs, such as those presented in the BASIC manual. Before long you'll be able to program anything you want. **/PC**

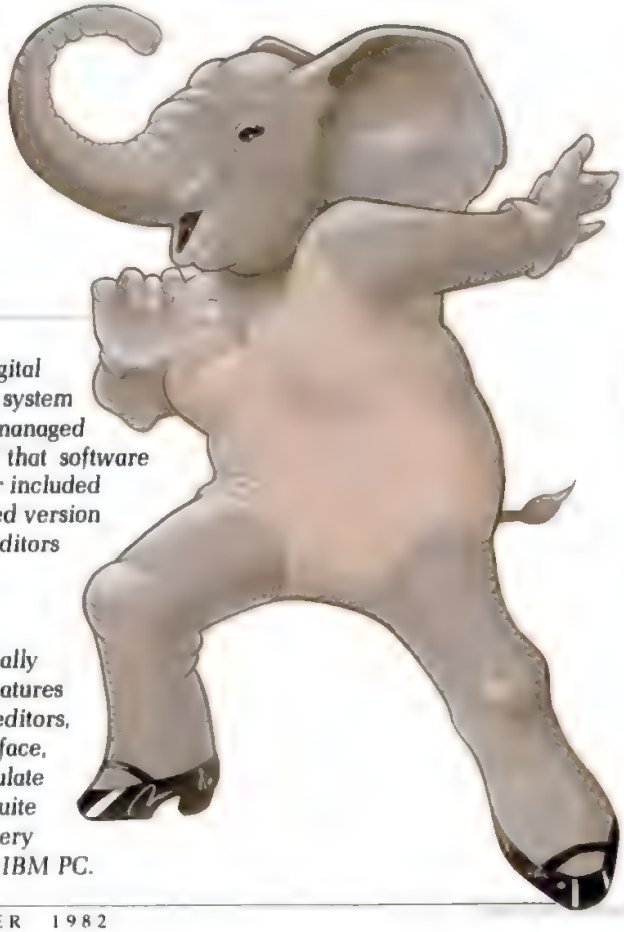
Editor's Note: The figures in this article illustrate techniques that apply to most data structures and access methods likely to be used with the PC. Other standard techniques exist, such as linked lists or tree structures, and more will be invented. Nearly all computer uses involve the storage and retrieval of data in structures. Knowledge of the design of data structures and the use of access methods will further your abilities to use your computer effectively in data base applications.

SOFTWARE/STEVE LEIBSON

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When Microsoft cloned Digital Research's CP/M operating system and came up with MS-DOS, it managed to retain the worst feature of that software package. EDLIN, *the line editor included with DOS, is a slightly improved version of* ED, *the CP/M editor. Line editors are the dinosaurs of computer history. There is no excuse for replicating a utility with such primitive functionality, especially with the advanced hardware features offered by the IBM PC. Screen editors, with their superior human interface, allow you to create and manipulate text files more easily. I was quite excited to discover* EDIX, *a very powerful screen editor for the IBM PC.*

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EDIX is a screen-oriented text editor that takes advantage of the display and user-definable function keys of the IBM PC. *EDIX* offers all the features of a good screen editor: text creation, insertion and deletion, block move and copy, cursor control using cursor keys, automated search and replace, and rapid screen update.

EDIX also offers some very powerful features not usually found in screen editors. The outstanding operating feature of *EDIX* is "multiple windowing"—you can open one to 12 text buffers, and up to four of them can be displayed on the screen at one time. Each window can be scrolled horizontally and vertically without affecting the other windows. Text can be moved and copied between the different buffers and windows.

Another feature is the on-line Help capability. Any time during the editing process the user can activate the Help feature, and a full screen describing the *EDIX* commands will appear. Second and third Help screens are also available. Help files keep the time spent searching in manuals to a minimum.

Figure 1: EDIX Commands

ALT-1	Move cursor to window 1
ALT-2	Move cursor to window 2
ALT-3	Move cursor to window 3
ALT-4	Move cursor to window 4
ALT-a	Append a blank line after the current line
ALT-b	Select a buffer for the current window
ALT-c	Copy a selected block
ALT-d	Delete the current line
ALT-e	Bring a file in from the disk for editing
ALT-f	Associate a file name with the current buffer
ALT-g	Go to a specified line number
ALT-h	Activate HELP
ALT-i	Insert a blank line above the current line
ALT-j	Next lesson, used in the tutorial
ALT-k	Mark a block
ALT-m	Block move
ALT-o	Place one window on the screen
ALT-p	Status display of active buffers, windows and files
ALT-q	Previous lesson, used in the tutorial
ALT-r	Read a file into the current buffer after current line
ALT-s	Search for a string
ALT-t	Translate from one string to another
ALT-u	Undo the last line deletion
ALT-w	Write a buffer to the disk
ALT-x	Exit *EDIX*
ALT-y	Move cursor to beginning of current line
ALT-z	Move cursor to end of current line

System Requirements

EDIX requires an IBM PC with at least 96K, one floppy disk drive, and either a color or monochrome monitor. With 128K, up to 40,000 text characters can be manipulated. *EDIX* cannot make use of more than 128K. The software is supplied on one diskette along with a 62-page manual.

Two batch command files are included with the *EDIX* software: STUDENT.BAT and GRADUATE.BAT. Executing STUDENT.BAT configures *EDIX* for the training mode. After this configuration is made, activating *EDIX* starts you on a 28-lesson tutorial on the use of the editor. Each lesson is fairly simple; the entire course requires less than an hour.

Emerging Technology Consultants is to be congratulated on its programmed tutorial, which shows how to create and modify text files in a witty and interesting style. This type of initation offers easy mastery. It is certainly better than spending an hour or two with the manual before taking the first faltering steps. A demonstration tutorial is available for $15. The only difference between the demonstration version and the real thing is that the demo software cannot write files to disk.

Using EDIX

Executing the GRADUATE batch file after completing the tutorial transforms *EDIX* into the complete text editor. When *EDIX* is executed, you are presented with a blank, single-window screen and a message/status area. Simply type in your text. Each line is ended by typing a return, except the last line in the file, which has an automatic return. *EDIX* allows lines of up to 254 characters, including the return (referred to as an end-of-line character).

A single window occupies the top 22 lines of the display. Line 24 is used for prompt messages from the editor and line 25 for error messages. A status display on line 25 tells which buffer you are editing, the name of the associated file and what line you are on in the buffer. A continuous horizontal line separates the text area from message and status areas.

EDIX uses the Alt key for all commands. The Help feature, for example, is activated by pressing [Alt] and [H] simultaneously. I find this convenient since the Alt key is in the bottom row of the keyboard and easily reached.

NOTABLY missing is a block delete command.

There are 29 Alt commands. Some are used to manipulate the screen and window display, others for line or character deletion, and the rest for file control. Files may be read in from the floppy disk for editing and written out when completed. Figure 1 lists all the *EDIX* Alt commands.

Ten of the Alt commands are duplicated on special function keys at the right side of the keyboard. Keys F1 through F4 activate text windows 1 through 4 respectively; F5 and F6 move the cursor to the extreme left and right of the current line; F7 activates the Help feature; F8 is used for marking lines for block commands; F9 is the line delete key; and F10 activates the search function. Special function key assignments are arbitrarily reassigned by creating a text file called FCNKEY.EDX, which overrides the default values of the special function keys.

A buffer of the last 20 deleted lines is maintained, so if you delete a line by mistake, the Alt-u, or "undo," command can restore it. This command is especially helpful for butterfinger users who edit programs at 2 a.m.

Windows

The concept of windows in *EDIX* is probably new to most microcomputer users. Windows are rectangular areas on the screen into which text is placed. Most of

the time the IBM PC uses the screen as one large window, 80 characters wide by 25 lines high. *EDIX* divides the screen into as many as four smaller areas, which occur on the screen at one time.

Each window is associated with a text buffer. *EDIX* supports up to 12 text buffers simultaneously, but the total number of characters stored in all 12 buffers is limited to approximately 40,000. A window is rarely large enough to show all the text in its associated buffer; therefore, *EDIX* allows you to move or scroll the window vertically or horizontally to see any portion of the text buffer. Each window is independent; as you move around in one window, the others remain unchanged.

The main advantage of windows is the ability to extract text from one file and place it in a second file. This feature is useful when copying a subroutine or other block of text from one program to another. *EDIX* supports this type of operation with block move and block copy operations.

Block Operations

Relocating lines and blocks of text is often necessary, especially when a common routine is repeated several times within a program. *EDIX* provides a relatively simple text-moving routine.

The command, Alt-K, is used to bracket the lines of text you want to move. (It doesn't matter to *EDIX* whether the beginning or end of the block is marked first.) If only one command is entered, *EDIX* sends the message, "Waiting for second mark," to remind you that the marking sequence is not complete.

After the block is marked, *EDIX* highlights the selected lines by displaying them in high intensity. This feature requires that you adjust the intensity and contrast controls on the display monitor. A section in the *EDIX* manual explains how to adjust the display contrast, an indication of the thoroughness of the documentation.

If you leave a window in the middle of the marking sequence, *EDIX* cancels the operation. A selected sequence cannot move across window boundaries; however, a block of text may be copied and then moved. The destination of the copy/move process is indicated by the cursor position before the copy or move command is entered.

Block operations have a few irritating aspects. Notably missing is a block delete command. This command is useful when extensively modifying an old file. Block operations work on whole lines only. You cannot move or copy a single phrase or word. Moving or copying a block to the exact beginning of a buffer is not possible since the block is always moved to the line following the cursor. You can circumvent this by placing a blank line at the beginning of the file, performing the copy or move, and then deleting the blank line, but this process seems more complex than necessary.

META-characters are similar to wild cards but more powerful.

Search and Translate

The most complex and powerful features of *EDIX* are the search and translate operations. If you want to find a word or other group of characters, *EDIX* will automatically search for them, once specified. If you want to change one group of characters into another, translate will accomplish that task.

Patterns may be completely specified, or *EDIX* "metacharacters" may be used for greater capabilities. Metacharacters are similar to wild cards but are more powerful. In MS-DOS the question mark and asterisk can be used in a file specification as wild cards. Any character matches a question mark, and any string of characters matches an asterisk.

EDIX uses the question mark and asterisk in the same manner, to specify search or translate patterns, and it adds five more metacharacters, allowing the search operation to ignore spaces, to match only if the pattern is at the beginning or end of a line, and to specify a set of characters that are allowable matches. The metacharacters can be considered a simple programming language used in search and translate operations.

The translate feature is somewhat limiting. I often want to change every occurrence of a text string in a program. *EDIX* finds every occurrence of the string, and then it stops and asks if the string should be replaced. You must manually specify replacement each time the search turns up the specified string. If the string appears often, the operation quickly becomes tedious.

Pausing for an explicit command for each replacement is probably the safest approach Emerging Technology Consultants could have taken. You certainly can't destroy large portions of your text accidentally. However, I feel that there should be a way to specify a global replacement.

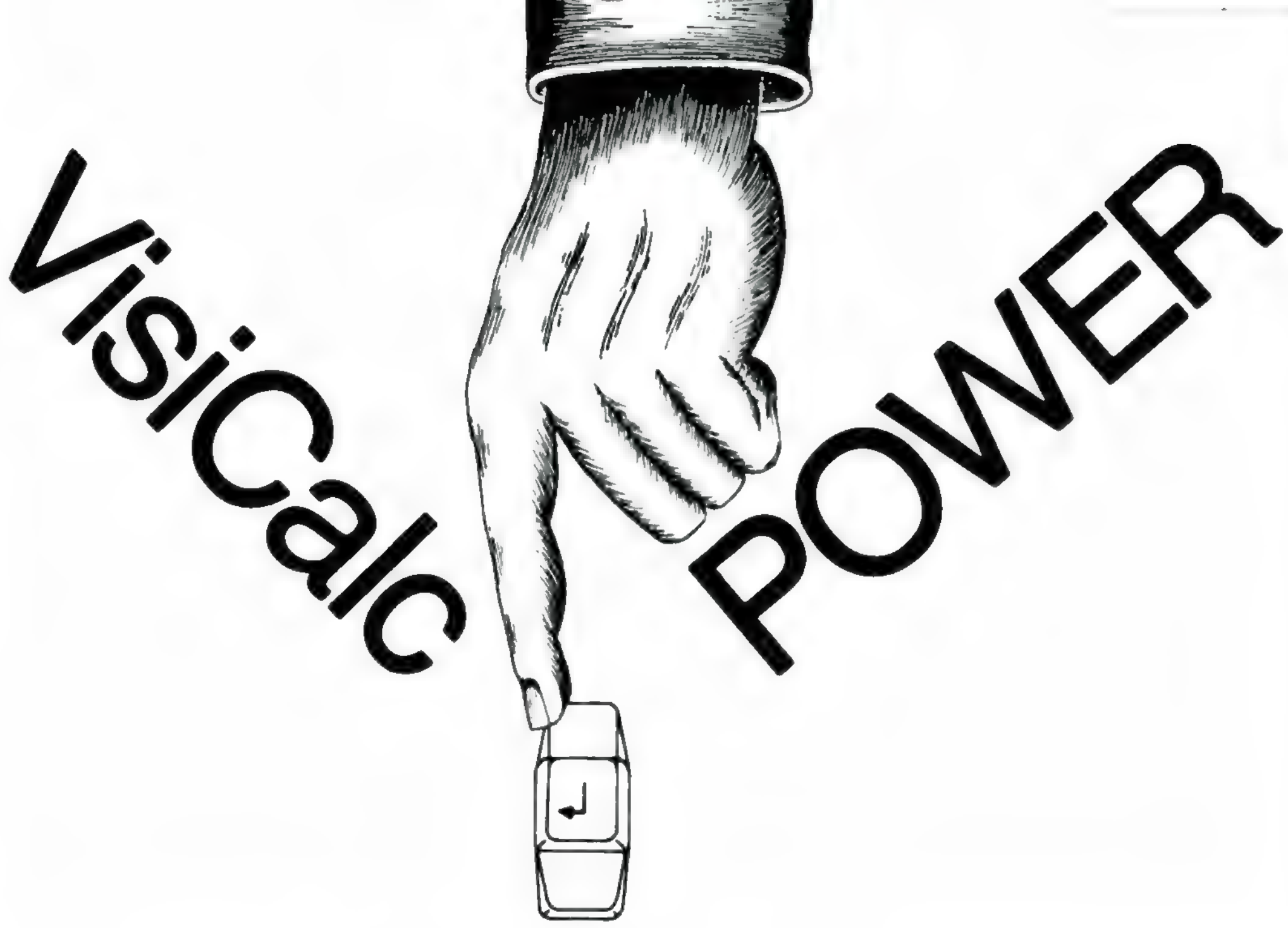
I was able to find only one bug in *EDIX*, revealed in the tutorial. During a search task, if the pattern is matched by a word not completely displayed on the screen, *EDIX* will not drag the word onto the screen. The operation of the search command is not affected, but those of us who don't completely trust the computer and want to see everything will be irritated. Manually moving the text onto the screen presents a simple solution to the problem.

Certain features could enhance *EDIX*, such as the capability to force an automatic, global replacement during the translation operation. Also, *EDIX* authors have left out the ability to overwrite text, claiming it complicates matters for novices and leads to lost text. I don't agree. I have found overwriting useful for such jobs as modifying envelopes and changing jump tables.

EDIX is what a programmer needs to create source text files in both Pascal and assembly language. The line orientation, multiple windows, and search with metacharacters are the editing tools needed.

EDIX works well and quickly as a text editor; however, it is not as useful as a word processor. Each line must be terminated by a return, and there is no word wraparound. It does not support print enhancements such as underlining or boldface; in fact, *EDIX* does not support a printer at all (there is no print command).

At $195 the software package is a good value. It works well and has many powerful features. If you have been using *EDLIN* for creating your programs, I strongly encourage you to look into *EDIX* as a replacement. **/PC**



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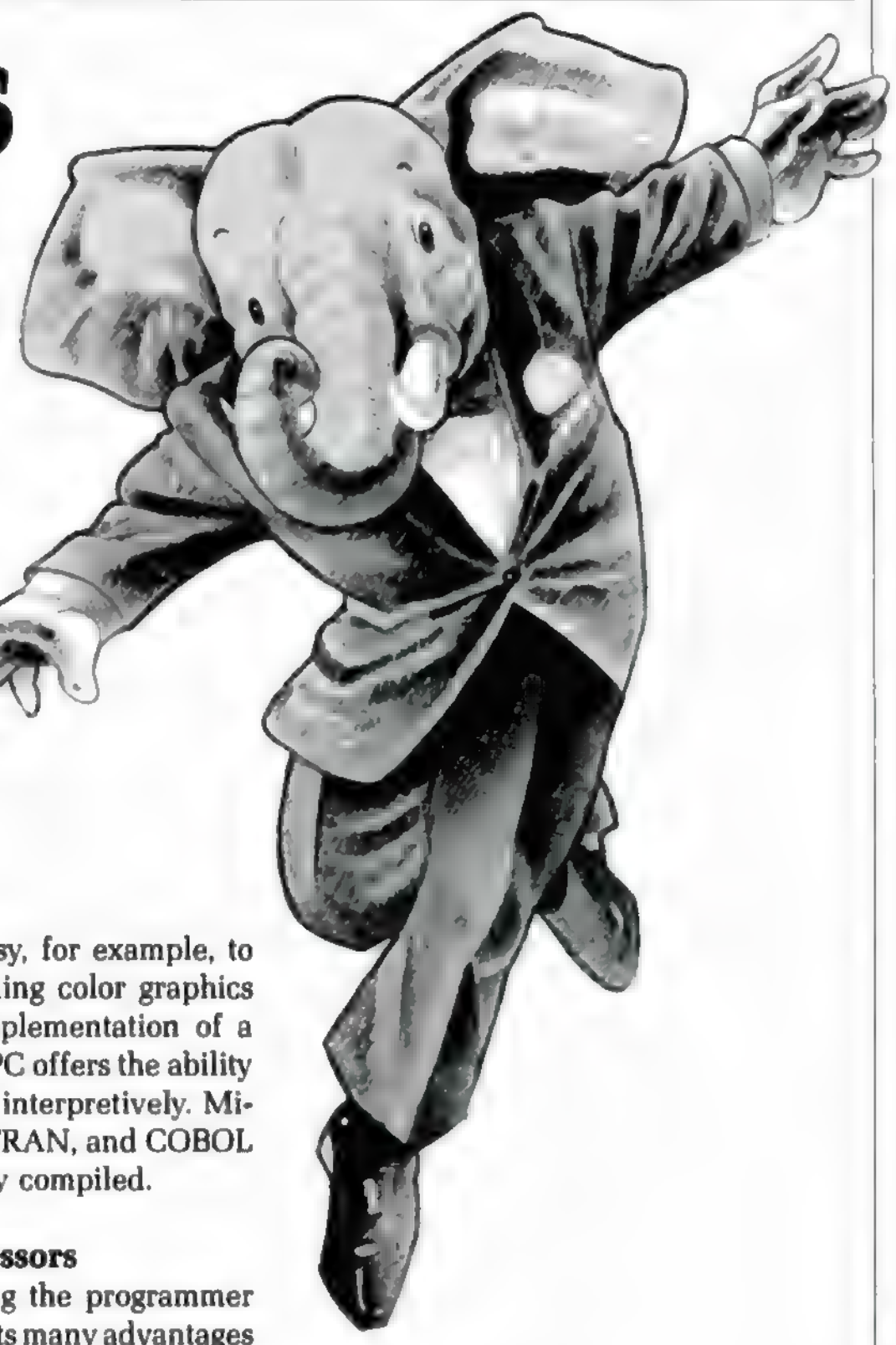
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SOFTWARE/WILLIAM F. SHARPE & BRENT D. WEAVER

RatBAS Basics

The inventors of a new language explain how it allows users to write structured programs while retaining the advantages of the BASIC interpreter.



Programming languages abound, as do implementations. Users of the IBM Personal Computer can program in BASIC, Pascal, FORTRAN, or COBOL using compilers and/or interpreters supported by IBM. Several other languages have also been implemented on the PC. No language is best for all purposes and all programmers. Moreover, the manner in which a language is implemented is often as important as the design of the language itself.

Modern languages facilitate modular programming. One need not consider an entire problem all at once. Pieces of the program can be written separately and put together as required to solve the overall problem. Further advantages can be gained with a language designed for structured programming, in which control structures are explicit, easily written, and easily understood. The trend is toward languages that make the first version of a program somewhat more difficult to write but greatly increase the likelihood that it will work correctly and substantially lower the cost of later revisions and enhancements.

IBM PC BASIC

Modular and structured programming were virtually impossible with original BASIC. When implementing for the IBM PC, Microsoft added a few structured features. The BASIC compiler provides limited support for modular programming, but following good programming practices is difficult using standard IBM (MicroSoft) BASIC.

IBM BASIC does offer many advantages, however. The original language has been enhanced by procedures that are useful for general programming and with statements and functions that allow efficient use of the hardware available for the IBM PC. It is very easy, for example, to write programs providing color graphics displays. No other implementation of a language for the IBM PC offers the ability to be compiled or run interpretively. MicroSoft's Pascal, FORTRAN, and COBOL programs must be fully compiled.

Language Preprocessors

The dilemma facing the programmer is: Select BASIC, with its many advantages but serious design flaws, or select one of the more modern languages. The latter choice forfeits the opportunity to debug programs in a fully interpretive mode.

Another alternative, however, is one that makes it possible to obtain the advantages of interpretive execution of BASIC and also write programs with good structure and at least some modularity. The needed ingredient is a preprocessor. A preprocessor translates programs written in a modified language to equivalent programs written in the target language. The target language is MicroSoft BASIC, as implemented on the IBM Personal Computer. The modified language is called RatBAS (rhymes with fat case), for Rational BASIC, and the translator is called RT for RatBAS Translator.

Many preprocessors of this type have been written. One of the best known is RatFOR, Rational FORTRAN, developed at Bell Laboratories. It inspired both our approach and the name of our language.

Design Objectives

To preserve the interpretive advantages of BASIC, it was important to minimize the difficulty of converting changes made in a BASIC program to comparable changes in the RatBAS version. Making the translation process rapid was equally important. This ruled out approaches in which each line of a RatBAS program would be examined in detail by the translator, with variable names changed. A one-to-one mapping between RatBAS lines and BASIC lines was desirable. For these reasons, we decided to make RatBAS similar to BASIC. We aimed to add benefits to the programming process without adding onerous costs.

The Pascal language was our model for RatBAS. Using a Pascal model facilitates conversion of RatBAS programs to comparable Pascal programs. It also eases the burden of converting a Pascal programmer to a BASIC (RatBAS) programmer.

Line Numbers

BASIC requires that every line have a line number. The numbers must be ordered from smaller to larger values. Several statements may be included on one line, but this makes the logic of a program obscure.

Line numbers perform two functions in BASIC. First, they serve as indicators to the BASIC editor of the appropriate positions of lines within the program. Second, they serve as the locations of statements for logical transfers like GOTO and GOSUB statements.

Good screen editors now make possible moving blocks of text from place to place, inserting text, and altering left margins for indentation. Such editors are much more powerful than the standard BASIC editor and function without the use of artificial line numbers. The use of line numbers as editing aids is thus neither necessary nor desirable.

Modern programming languages do not encourage the use of statement labels and transfers to statements based on labels. Many implementations make such transfers impossible. Instead, structured statements such as WHILE . . . WEND and FOR . . . NEXT, are used to make the logic clear and greatly reduce the chance of errors. Given adequate structure, line numbers as statement labels are also unnecessary and undesirable.

NO OTHER implementation of a language for the IBM PC offers the ability to be compiled or run interpretively.

The absence of line numbers in RatBAS makes writing modular programs easier. The user need not worry about a conflict of line numbers in one portion with those in another, or use renumbering to avoid problems in positioning.

Because the BASIC interpreter requires line numbers in the appropriate order, the RatBAS Translator (RT) will add a line number at the beginning of each line of a program unless instructed to do otherwise. To facilitate readability, RatBAS programs may contain blank lines; they are converted to lines with a blank comment (e.g., 310 ') by RT.

The RatBAS Task

To use Rat BAS, the authors recommend the following procedure.

Over the course of many months we have found that RatBAS can be used effectively with the following steps:

1. Draft a program in RatBAS and enter it via a screen editor.
2. Make a hard copy listing of the RatBAS version.
3. Translate the RatBAS version to BASIC (with all line numbers). If errors are found by RT, edit the RatBAS file and retranslate; post changes to the RatBAS listing as they are made.
4. Debug the program using the BASIC interpreter. Post any changes made to the listing of the RatBAS version, making any necessary conversions.
5. Re-edit the RatBAS file; retranslate and verify (using the interpreter) that the program is functioning correctly.
6. Translate the program again using the /n option.
7. Compile the program (fully or partially) to produce a machine language version.

In the process of debugging the BASIC program (step 4), the number of changes may become excessive; if so, it may be desirable to edit the RatBAS file to include the changes, and then repeat steps 2 and 3. This appears to be a formidable task. However, it can be quite fast (RT can translate approximately 500 statements per minute), and the gains in programming accuracy and efficiency can be substantial for any but the simplest programs.

—W.F.S. & B.D.W.

Lowercase Letters

The BASIC interpreter converts all lowercase letters in BASIC commands and variable names to uppercase. This reduces the opportunity to use mnemonics. Clearly, "NumberOfRows" conveys more meaning than "NUMBEROFROWS." For this reason, RatBAS allows upper- and lowercase letters.

Variable Types

Many languages allow and some require declarations indicating the name and type (integer, real, etc.) of every variable, making it possible to check for typographical errors. The most typical and most difficult to see are the transliterated characters within a variable name. In BASIC, such declarations are allowed for arrays only. The type of a variable is indicated by the first and/or last character of its name.

One can end a variable name with a type designator (% for integer), but this leads to unaesthetic programs. Alternatively, the user can designate certain letters to indicate a standard type. The statement "DEFINT I-N" indicates that all variables with names beginning with I,J,K,L,M, or N are to be of type integer unless their names end with another type of designator. To facilitate designation of variable types with the first letter of a name, RT places the above statement at the beginning of every program it produces. As in FORTRAN, any variable with a name starting with I through N will be of type integer; all others will be of type real. To override these default conditions, the user can add a type designator as the last character of a variable's name or insert additional DEF-statements in the RatBAS program.

True and False

In BASIC all logical comparisons evaluate to either -1 (true) or 0 (false). To facilitate readability, RT places the following statement as the first executable statement of the translated program:

```
false = 0: true = not false
```

One can use statements such as:

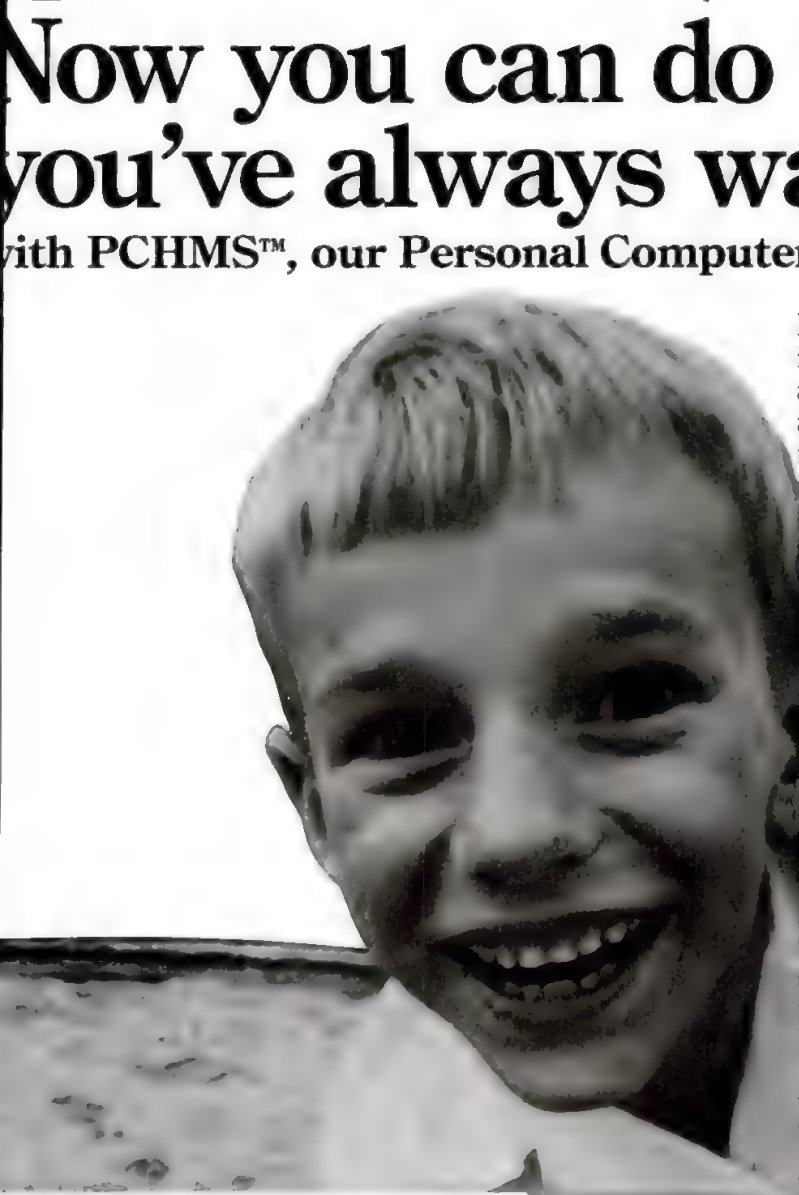
```
Done = false
while not done
    ....
    if ..... then done = true
wend
```

Declarations

In BASIC, arrays need not be explicitly

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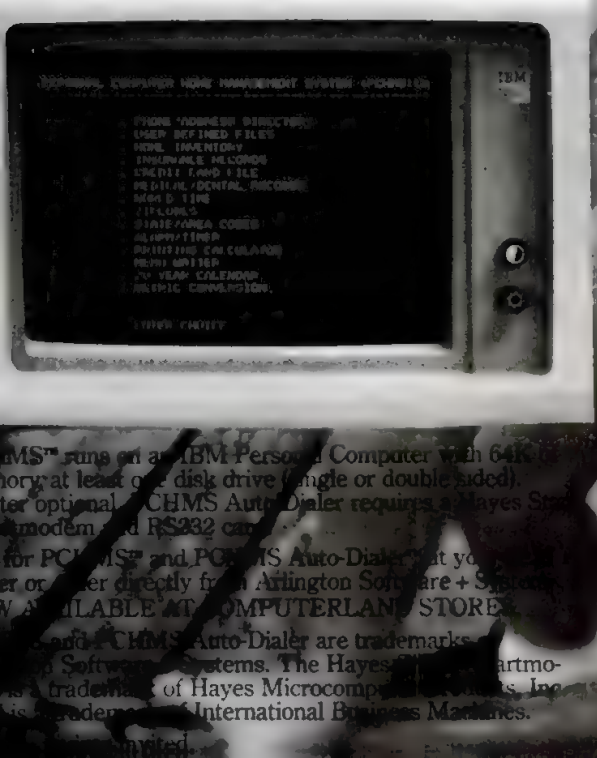
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declared unless their dimensions exceed 10. The BASIC interpreter executes DIM statements while the program is running, which makes it possible to choose a dimension for an array based on the conditions at the time (e.g., DIM X(N)) and to dimension arrays only when required. Unfortunately, the BASIC compiler does not allow such procedures. Instead, dimensions must be "hard" (e.g., DIM X(100)) and dimension statements must physically precede the use of the dimensioned variables. Function definitions must also physically precede the use of the related functions.

For programs to be usable in both modes, place all function definitions and array dimension statements at the top of the program along with any common statements. A typical program might start with the following:

```
'PROGRAM Zilch
'does useless calculations
COMMON x$, y$
'FUNCTIONS
   Def FNArea(r)=pi*r^2
   Def FNFoo(x)=x/10
'ARRAYS
   DIM LenRow(12) ' lengths of rows
   DIM LenCol(12) ' lengths of columns
```

RatBAS Specific Statements

Most lines of a RatBAS program are standard BASIC statements, lacking only line numbers. Fewer than half the lines of such a program use features that are specific to RatBAS. Each line must be flagged in a very simple way by ending it with a right bracket.

If..Then..Else Statements

BASIC provides three major structured statements. Any number of statements may be included between a WHILE and WEND or between a FOR and NEXT. Unfortunately, this is not the case for the IF statement. Such a statement must occupy one logical line (up to 255 characters long).

THE LACK of "local" variables in BASIC is a serious drawback.

At best this limitation makes it difficult to detect the logic involved in a complicated algorithm.

To solve this problem RatBAS includes an alternative IF structure. The syntax is:

```
IF <condition> THEN]
        <statement>
        <statement>
              .
              .
     ELSE]
        <statement>
        <statement>
              .
              .
IFEND]
```

The <condition> may be any expression that will evaluate to true or false; <statements> may be any legal BASIC (or RatBAS) statements.

Although not required, program readability is greatly enhanced if levels of logic are portrayed by indentation.

```
For i=1 to 10
   x(1)=y(1)
Next i
If a>b then]
      a=3
   else]
      a=5
ifend]
```

In RatBAS the IF statement ELSE clause may be omitted.

CASE Statements

RatBAS provides an additional structure not present in BASIC. It's syntax is:

```
CASE <lhs> OF]
     <rhs> :]
           <statement>
           <statement>
                 .
     <rhs> :]
           <statement>
                 .
                 .
              .
              .
   OTHERWISE]
           <statement>
           <statement>
                 .
CEND]
```


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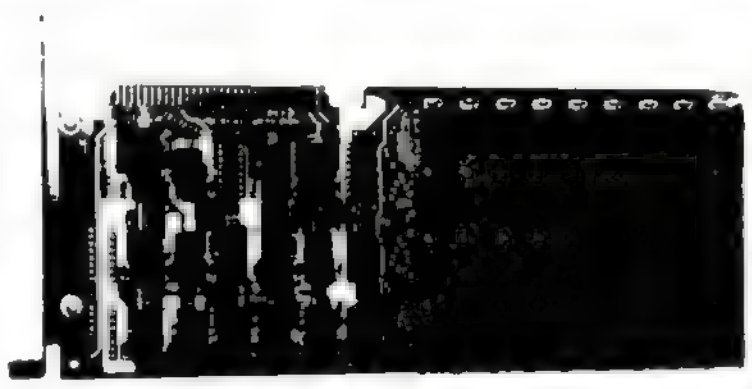
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<1hs> may be anything that can be placed on the left side of the equality in an IF statement; <rhs> may be anything that can be placed on the right side of the equality. Optionally, <rhs> may be composed of two or more such expressions, separated by commas. If OTHERWISE] is omitted, an implicit OTHERWISE] with no statements is assumed.

```
CASE name$ OF]
   ''Bill'', ''BILL'' :]
               print ''Brent says hello''
  ''Brent'',''BRENT'' :]
               print ''Bill says hello''
             OTHERWISE]
               print ''I don't know you''
CEND]
```

Procedures

One of the most vexing aspects of BASIC is its use of subroutines. Logical programming dictates extensive use of small, logical modules. In BASIC, functions and subroutines must be used for this purpose. Functions are limited to single statements and consequently are highly restricted. Subroutines are called by line number rather than name and have neither arguments nor local variables.

In RatBAS the role of the subroutine is performed by the Procedure. A RatBAS program has the overall form:

```
<declarations>
      <procedure>
      <procedure>
         .
         .
         .
<procedure>
PROGRAM]
   <program statements>
END
```

A procedure without arguments has the form:

```
PROCEDURE <procedure name>]
      <statement>
      <statement>
         .
         .
         .
PEND]
```

A procedure name may have any number of characters. Upper- and/or lowercase letters may be used, but no distinction is made between them; ZILCH and Zilch refer to the same procedure.

A procedure may be invoked simply by ending a statement with its name.

```
PROCEDURE Foo]
   print ''this is foo''
PEND]
```

```
PROGRAM]
   Foo]
   input x
   if x>3 then foo]
END
```

A procedure may be called (invoked) within a program or within another procedure; however, the procedure declaration must physically precede all references to it. A procedure may not be declared within another procedure. When called, the procedure name must be the last item on a statement line. It may appear in any position in which GOSUB... would be legal.

THE DILEMMA facing the programmer is: Select BASIC, with its many advantages but serious design flaws, or select one of the more modern languages.

ERROR Procedure

BASIC allows error trapping. If such trapping is "enabled," programs will not terminate when an error occurs. To enable error trapping in a RatBAS program, include a procedure with the reserved name ERROR. Whenever an error occurs, this procedure will be invoked. When the statements in procedure ERROR have been executed, the program will resume.

Procedure Arguments

The lack of "local" variables in BASIC is a serious drawback. With the sole exception of single-statement functions, every variable is global; only one variable is named X. One cannot, for example, declare variable X in procedure zilch to be different from variable X in procedure foo. There is no direct way to state that variables X and Y in a procedure are to "stand for" whatever variables are indicated when the procedure is called. This makes it very difficult to write modules for

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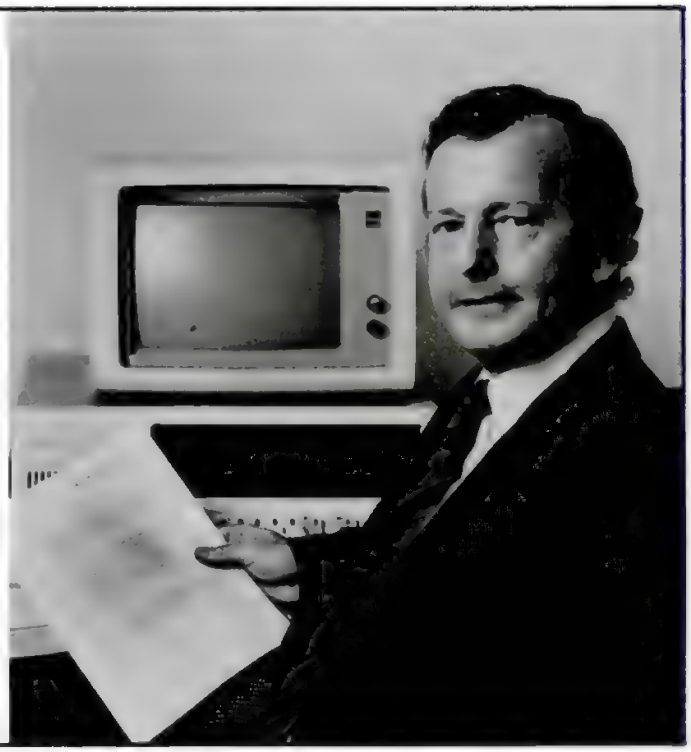
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use as "black boxes" in programs, due to the possibility of using similar variable names in other portions of the program with unsuspected and unwanted results.

One programming practice that can help mitigate this problem is to use unique names for variables that are intended to be local to a procedure. A generally successful strategy is to select typical names for such variables, and then append the procedure name to each one using a period as a separator.

```
PROCEDURE foo]
   for i.foo = 1 to 10
      print i.foo
   next i.foo
PEND]
```

Another good practice is to include a description at the beginning of each procedure of both the "normal" variables used and what is done to them.

```
PROCEDURE Zilch]
'sorts array X from X(1) to X(N) in increasing order


PEND]
```

RatBAS provides some help in this regard. Procedures may have arguments; however, only simple variables are allowed. Arrays may not be used.

Arguments in a procedure declaration are indicated by a series of variable names, separated by commas and enclosed in parentheses.

```
PROCEDURE Zilch (a.zilch, b.zilch, c.zilch)]
```

Statements invoking such procedures must provide corresponding arguments.

```
Zilch (c.d.e)]
```

The effect of the above statement would be:

```
a.zilch = c
b.zilch = d
c.zilch = e
'' do zilch ''
```

Note that arguments c, d, and e are passed to the procedure, but no resulting values are passed back. This ensures that no change is made in a global variable, which may be desirable in many cases. The user may want one or more of the arguments of a procedure to be passed back when the procedure is called. If so, the argument variable must be prefixed with V: (or VAR:) in the procedure declaration.

```
PROCEDURE SUM (a.sum, b.sum, V:c.sum )]
   c.sum = a.sum + b.sum
PEND]
PROGRAM]
         x=3
         sum (x,5,z)]
         print x

END
```

The effect of the above is:

```
a.sum = x
b.sum = 5
c.sum = z
'' Do SUM''
z = c.sum
```

A procedure declaration must contain only variables (plus, optionally, V: prefixes). A procedure call (invocation) may contain expressions of any type for arguments that is not "variable"—passed back.

INCLUDE Files

When writing programs in a modular manner, a user typically accumulates a series of modules (in RatBAS, usually Procedures) that can be used in various programs. By placing one or more such procedures in a file, it is a simple matter to include them in a new program. If appropriate variable names and/or arguments have been employed, it is also possible to treat them as "black boxes," which perform a given function, without bothering about the actual operations performed internally.

A user can insert files in other files with a good text editor. RT makes it possible to do this directly. One need only insert an INCLUDE statement in the appropriate position in a RatBAS program.

```
INCLUDE String.INC]
```

This places the statements in the file STRING.INC as if they had been at that position in the original. The file name may include a disk drive designator:

```
INCLUDE b:string.inc]
```

If no disk drive designator is given, the file is assumed to be on the "include file disk." When RT is run, the user may specify that the disk be used for this purpose. Otherwise, it is the current default disk.

If no file extension is given, .INC is assumed.

```
INCLUDE String]
```

is equivalent to:

```
INCLUDE String.INC]
```

Include files are particularly helpful for situations in which a block of code is to be used in several programs. If a change must be made in the block, only one file need be edited. By retranslating all pro-

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grams using the block, one can obtain new versions with no danger of inconsistent changes.

A USER CAN insert files in other files with a good text editor. RT makes it possible to do this directly.

Starting the Translator

To translate a RatBAS program to an equivalent BASIC program, the user simply starts RT from DOS:

```
A>RT
```

The program then requests the name of the file to be translated. The user then gives the file name (preceded by a disk drive if needed). If no extension is given, .RAT is assumed.

The next prompt asks for the disk drive on which any INCLUDE files are located:

```
Disk for any Include files [default]:
```

The user may respond with a drive (e.g., B, or B:) or with only a return; in the latter case the default drive will be used.

The program next asks for the name of the file for the BASIC program to be produced. A file with the same name as the RatBAS file, but with a .BAS extension is the default; to select it, the user simply presses a carriage return. Otherwise, a file name (with disk drive if needed) can be given. A typical set of responses would be:

```
RatBAS file: Zilch
Disk for any Include Files [default] : (return) Output File [zilch.BAS]:  (return)
```

If the default conditions are to be used for the include file disk and the output file, the RatBAS program name can be followed by a semicolon, thus obviating further responses.

Programs designed to be used with the BASIC interpreter must have a line number for each line. RT will produce line numbers for each line unless instructed to do otherwise. If a program has been debugged and a compiled version is desired, it is preferable to produce a new BASIC version with line numbers only where needed (e.g., the first line of a Procedure, lines required by If..Then, and CASE statements). To do so, the user types /n after the RatBAS program name.

```
RatBAS File: zilch/n
```

or:

```
RatBAS File : zilch/n:
```

BASIC programs produced with the /n option cannot be run with the interpreter. It is important to use this option since the BASIC compiler only optimizes code between line numbers. As a result, a compiled program produced in this way will generally be both smaller and faster than one produced from a program that has all lines numbered.

RT Output

As the translation process proceeds, RT produces a log of its actions. Every procedure name is shown along with the line number at which it is located. Every statement is indicated by a symbol. Standard BASIC statements are indicated by dots. RatBAS-specific statements are indicated as follows:

```
I : If ... THEN
e : ELSE
i : IFEND

C : CASE ... OF
s : :] (case selection)
o : OTHERWISE
c : CEND

p : procedure call
```

This output provides a logical program map, which is often helpful for detecting errors.

When an error is encountered by RT, a message is displayed at the bottom of the screen and the user is given the option of terminating the translation or continuing. In the latter event, the BASIC program should not be used, but additional errors may be found easily. In some situations, one error leads to another, so this sort of procedure should be used with caution.

When an INCLUDE file is used, a message is displayed, indicating that it is being read. Another message is displayed when the read is completed.

BASIC programs produced by RT contain Procedures (subroutines), followed by a list of procedure locations, followed by the other statements in the program. The

list of procedure locations begins at line number 20,000. When debugging the BASIC program, finding a procedure is a simple matter. List lines 20000-... to find its location. Procedure calls are translated into GOSUB statements, commented with the procedure name to facilitate debugging. IF and CASE statements generate IF and GOTO statements; IFEND and CEND statements are converted to comment lines. **/PC**

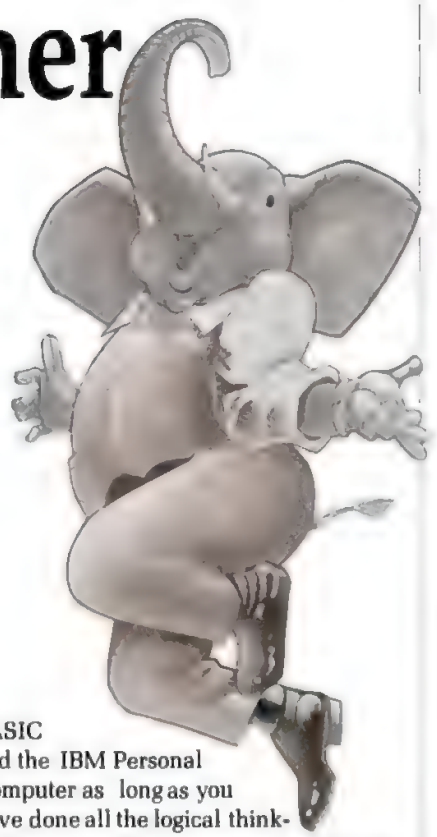
RatBAS was developed by William F. Sharpe and Brent D. Weaver for Wells Fargo Investment Advisors, where both authors are consultants. Sharpe is also Timken Professor of Finance at Stanford University. The authors acknowledge William Fouse, William Jahnke, and Ralph Goldsticker for their assistance in the development of RatBAS.

If you would like to receive a complimentary copy of the RatBAS translator, send $10 by check or money order (to cover the cost of the diskette mailer and postage) to Brent Weaver, Wells Fargo Investment Advisors, P.O. Box 44029, San Francisco, CA 94144.

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names and characteristics of variables.

The Programmer helps expedite routine coding chores by specifying parameters with a minimum of keystrokes, but it does not think for you, read your mind, or second guess your intentions. It is useful for users who are familiar with program design and who have had experience with logical program structuring.

The Package

The packaging is attractive and professional. The loose leafbinder stands up for easy use at the keyboard. The binder includes *The Programmer* diskette, extra labels for copies of the diskette and data diskettes, BASIC line number usage sheets for program planning, and a manual printed in large, readable type.

The Manual

The manual is divided into three sections. Section A is a system overview and introduction that gives suggestions for program development, system requirements, preliminary diskette formatting, and instructions for program transference and the start-up procedure.

Section B is a primer. It takes you carefully and completely through the necessary steps to key in a prepared sample mailing list program. The sample program allows you to store names and addresses, add records to the file or modify existing records, and print labels or a report of all records in the file. The mailing list program is menu driven and the file is random access.

The manual presents a short, useful course in programming technique and file management. It explains in easy-to-understand English topics such as file names and extensions, file types (random access and sequential), field name and length considerations, and field types (alphanumeric and numeric). It further explains program branching, file pointers, opening and closing files, and reading and writing records as they occur in the program.

The information in the primer can do a lot more than provide a good mailing list program. Although this is not explicitly stated in the documentation, the topics covered are things every good programmer should know and remember in the design and development of any program.

Section C is the reference manual. Since *The Programmer* is built on a pyramid of menus, each selection of a major topic area from the main system menu leads to another menu that offers detailed alternatives for the creation of BASIC statements. The reference manual explains each selection on the various menus.

Seven appendixes and an index follow Section C. The appendixes include details of the mailing list program and two shorter programs, disk files, variables, a reserved word list, and the layout of *The Programmer* itself. A list of books for further study is included.

THE documentation does not tell you how to change the line number.

Program Entry

The primer and sample mailing list program acquaint you with *The Programmer*'s menus and organization. Since *The Programmer* is built on a menu pyramid, entering the sample provides valuable practice in moving from the main system menu through the lower menus and back.

To save the program generated by *The Programmer* in one file, it's necessary to enter the complete program in one sitting. If you have to key in the program in more than one session, *The Programmer* saves parts of the program on the diskette under different names. By updating and exiting the program at the end of each session, all parts can be drawn together into one file. This becomes a stand-alone program with the extension .BAS. that can be run under DOS. Since it is difficult to change a stand-alone program through *The Programmer*, parts of the program should not be drawn together until the program has been completely entered.

When entering a program in more than one session, restart *The Programmer* to the desired program. This is an easy procedure but it is not well-documented in the manual. After booting up the system and *The Programmer* introduction, the system

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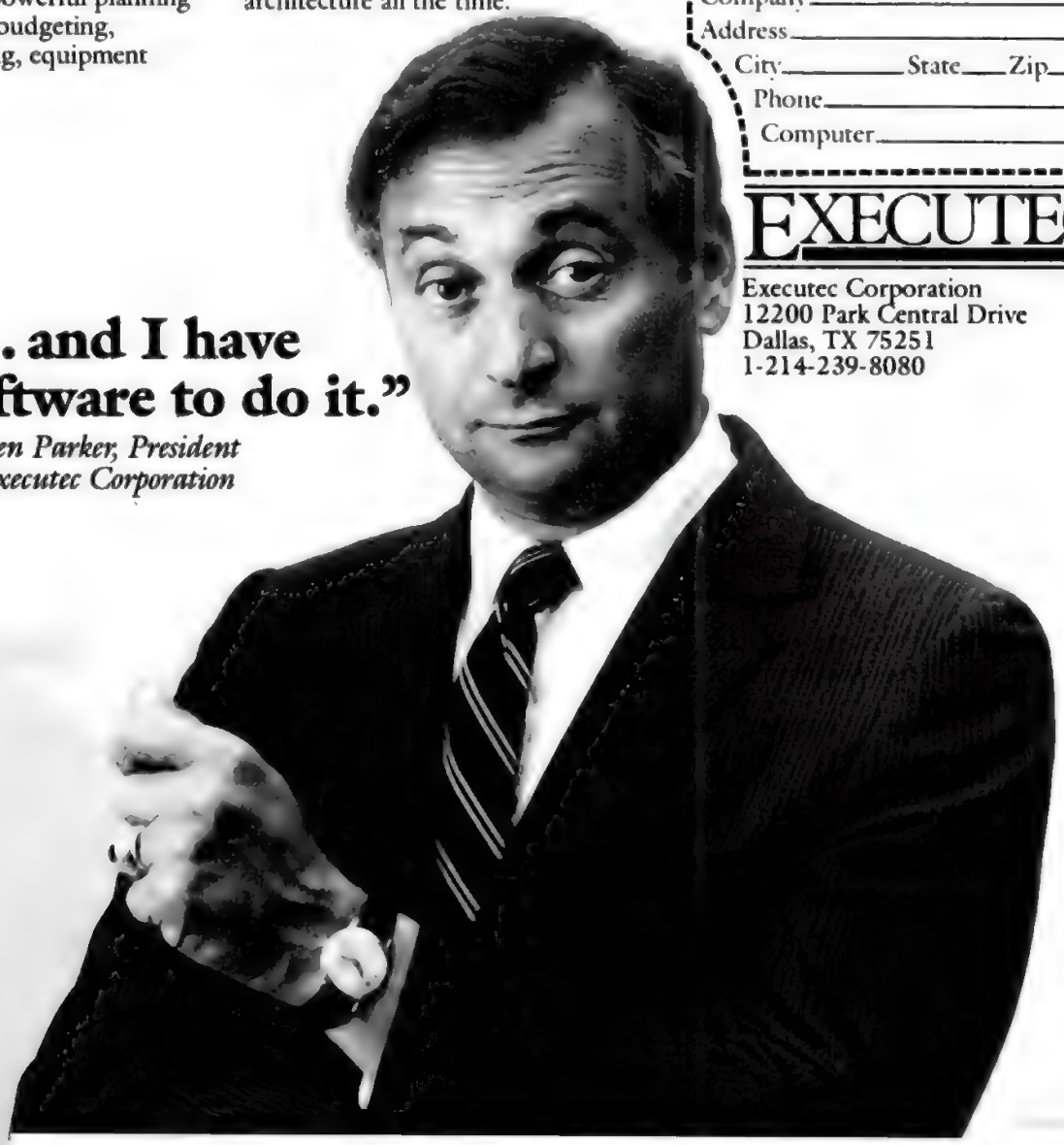
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maintenance screen lists the current program name. To continue working on the program listed, press [ENTER] twice and continue. The statements generated in this session become part of the output file name and are assigned a different number than the earlier statements.

The Programmer assumes you will enter one program completely before starting another. It would be nice if this were always the case, but it is often impossible. While it is not documented, *The Programmer* can generate more than one program at a time. The program name can be changed through the change data option on the system main screen. After entering a new program name, you may change other options. When entering more than one program at a time, watch the starting line number. If the line number start is not changed to agree with the proper program, the programs could end up with mixed sequences.

Errors and Corrections

One problem every programmer runs into is mistyping variable names or forgetting necessary functions. These mistakes often result in errors that must be debugged later. *The Programmer* gives an error message when this happens. However, correction of the error necessitates departure from *The Programmer*'s program development phase and correction of the error on a line by line basis. The manual lacks a listing of the error message definitions. A section entitled "Appendix A. Messages of the IBM PC BASIC manual (6025010)" includes explanations of these messages. This BASIC appendix may be used to supplement *The Programmer* documentation.

Since going in and out of *The Programmer* to correct errors as they happen can disrupt the flow of keying in instructions, make notes of the errors, including line numbers and functions. After all program instructions have been completed, all errors could be corrected at one time.

Program Listings

The Programmer lists programs two ways. It can list lines of program code generated in the current session. If you enter a program in four sessions, the printer listing generated after the fourth session covers only part four (another good reason to enter a program in one session). This listing is of code in the order it was generated—not in line-number order.

With this listing of the generated program you should be able to find and correct the syntax errors in your program. If a code line needs to be changed, the whole line, including the line number, must be retyped. "Retype a line" from the system utilities submenu accomplishes this. Unfortunately, *The Programmer* does not display the line to be corrected before it is retyped. You can get around this inconvenience by making the written corrections on the listing and retyping the complete line from that.

The second type of listing is of the program after all parts have been drawn together. This listing is in line-number order.

Adding Code

The Programmer allows you to add lines of BASIC code to the program under development. Program control, file control, alpha functions, and printer control are all menus that include an option called "BASIC statement." To correct errors after using *The Programmer* to generate code, you must be familiar enough with BASIC to write code.

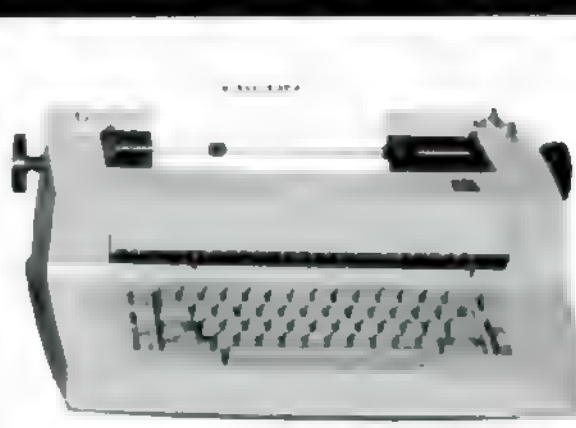
There are two options for adding BASIC code to the generated program. With the first you could call up the program under IBM-DOS and add the code under BASICA. This accesses the full-screen editing capabilities of BASICA. With the second, the user relies on *The Programmer* itself. The steps necessary to add code through *The Programmer* can be complex. The documentation does not adequately explain the steps involved. The manual says code can be added, but it leaves it up to the reader to figure out how.

Every user should be aware of two dont's before trying to add BASIC statements. Don't try to use the "retype a line" function to add code. You cannot change the code of a line number that isn't already in the program. Don't try to add code by pressing the "BASIC statement" number on a menu. The line number generated by *The Programmer* must be changed first. By pressing BASIC statement without changing the line number, *The Programmer* appends the code you are adding to its generated line number, so the new code would not be inserted where desired. To insert code in the middle of a program,

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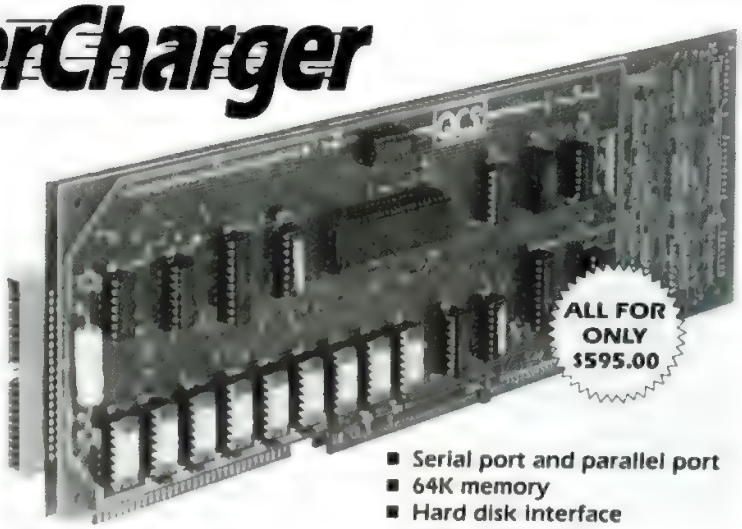
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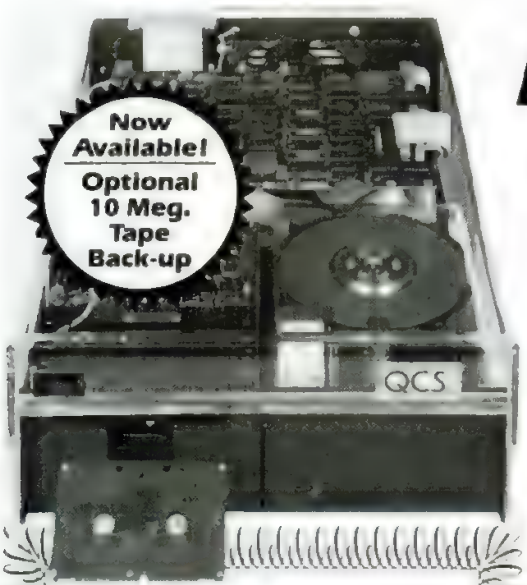


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change the line number displayed by *The Programmer*.

The documentation does not tell how to change the line number. Here's how: Bring up the program control menu; press the F6 function key; with the cursor over the existing line number, enter the line number for the code to be added; and after noting the syntax warning message (it warns that no error checking will be done on input), enter your BASIC statement. *The Programmer* will then generate a new line number. If you need to add more code, use the same steps.

Since *The Programmer* requires that you specify the order and details of a program, there is no guarantee that when it is free of error messages it will execute correctly. Debugging the logic of the program will be just as necessary as with any program written without *The Programmer*.

The Programmer can be a useful shortcut coding tool. It is not, however, a true program generator because it requires that you specify each step in the program you are instructing it to code, including most opening and closing of files, each reading and writing of records, and every branch statement and loop needed. To produce code, many program generators demand only that you define files and the variables within them, what screens should look like, what reports are desired from the program, and any program logic other than standard file processing. *The Programmer* would be more accurately described as a menu-driven programming language that is interpreted into BASIC.

The Programmer demands practice for proficiency with its menus and careful entry of information in the form *The Programmer* can understand.

Since *The Programmer* requires complete planning and logical thought before use and demands familiarity with its unique set of instructions, the system is very difficult for an inexperienced programmer to use. Although the documentation states that knowledge of program design, system planning, and flow charting is not essential to use *The Programmer* effectively, a solid background in all of the above as well as an understanding of BASIC (to debug a program) are vital.

The Programmer could be a significant timesaver, well worth the cost, for experienced users who frequently write routine, repetitive coding. ***/PC***

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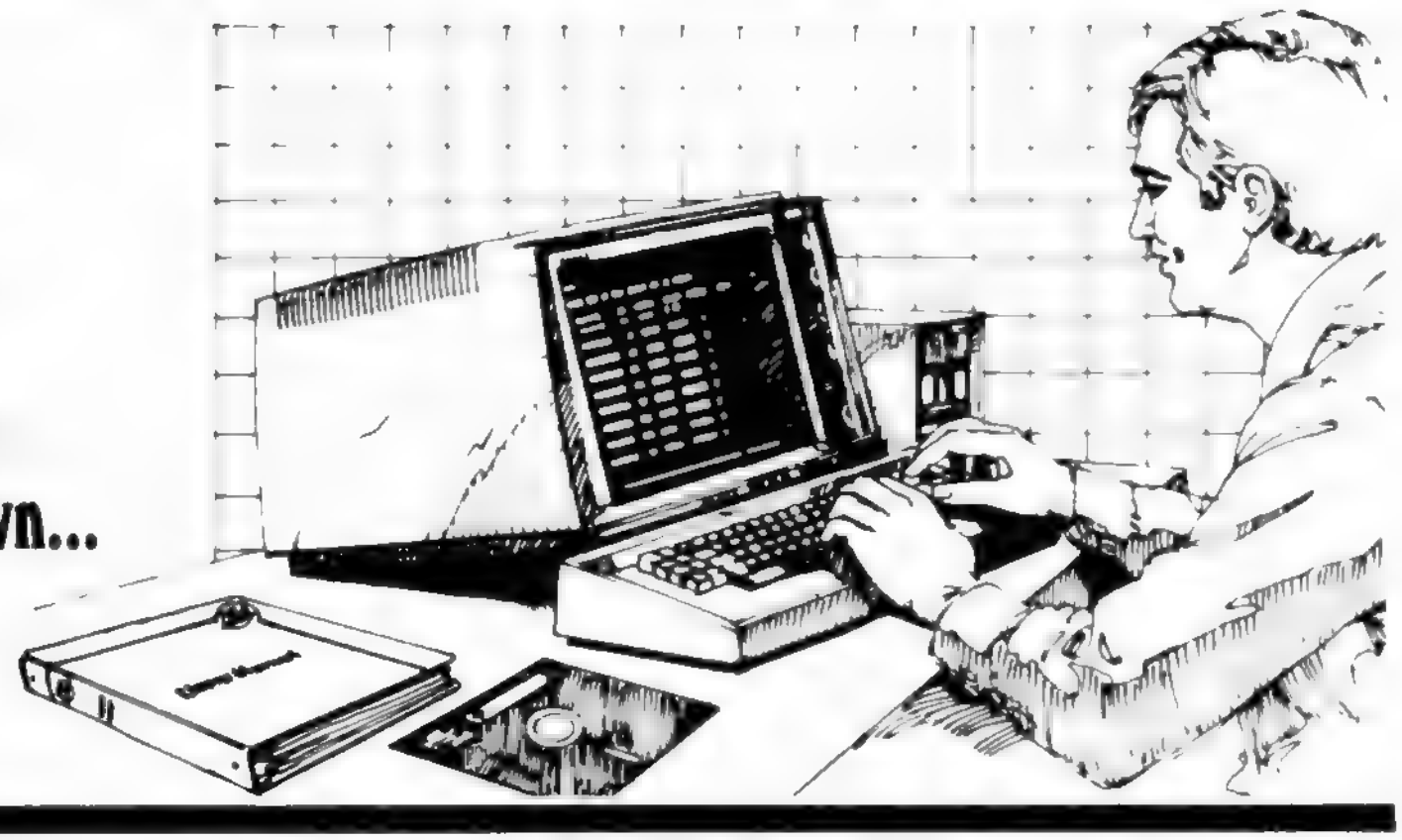
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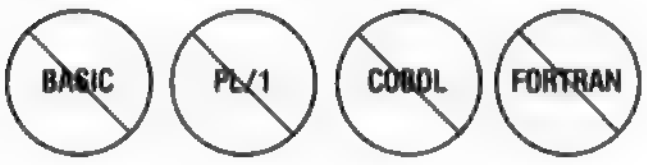
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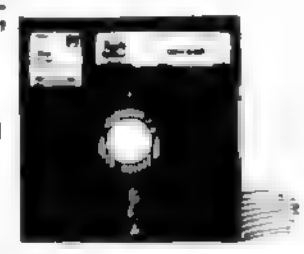
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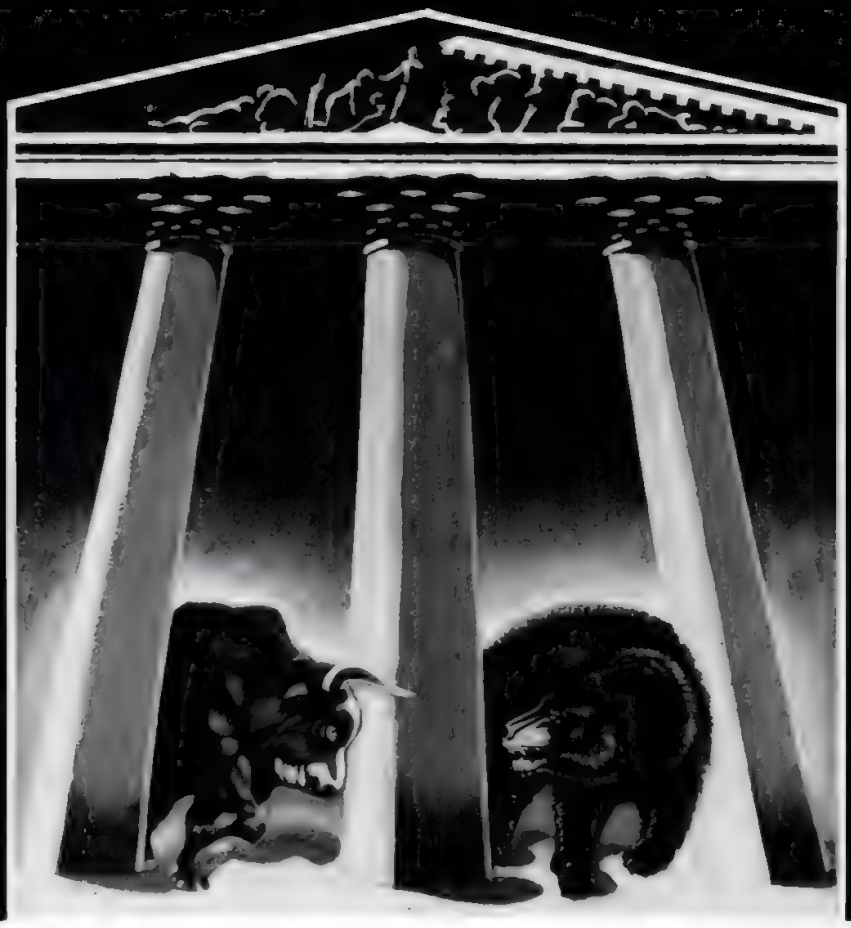
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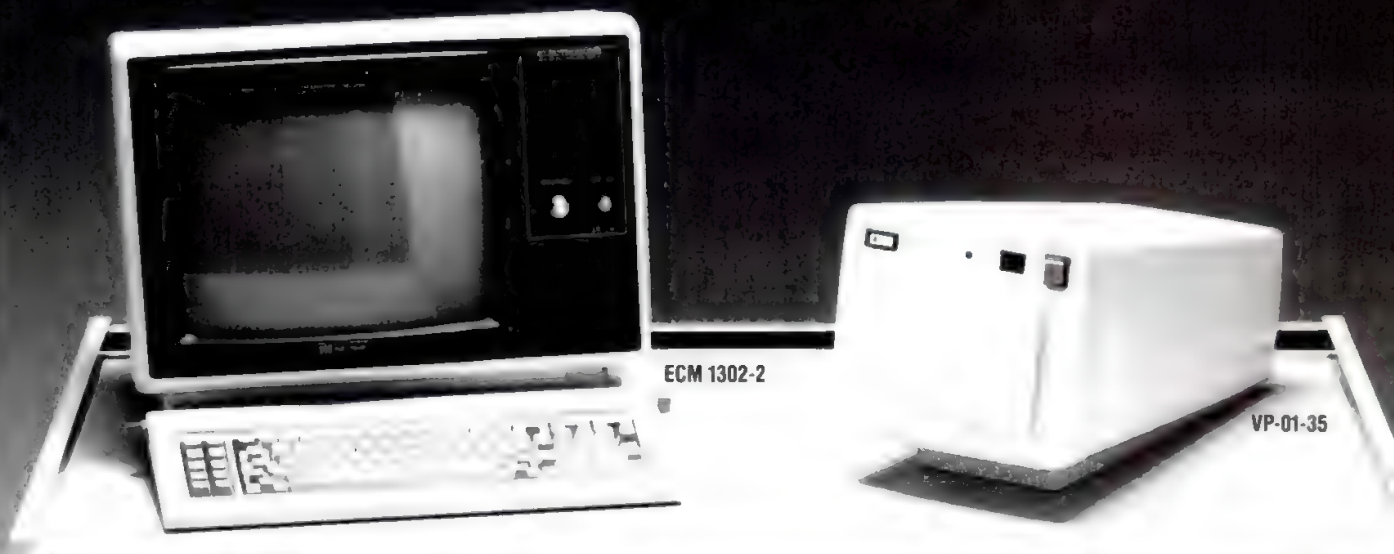
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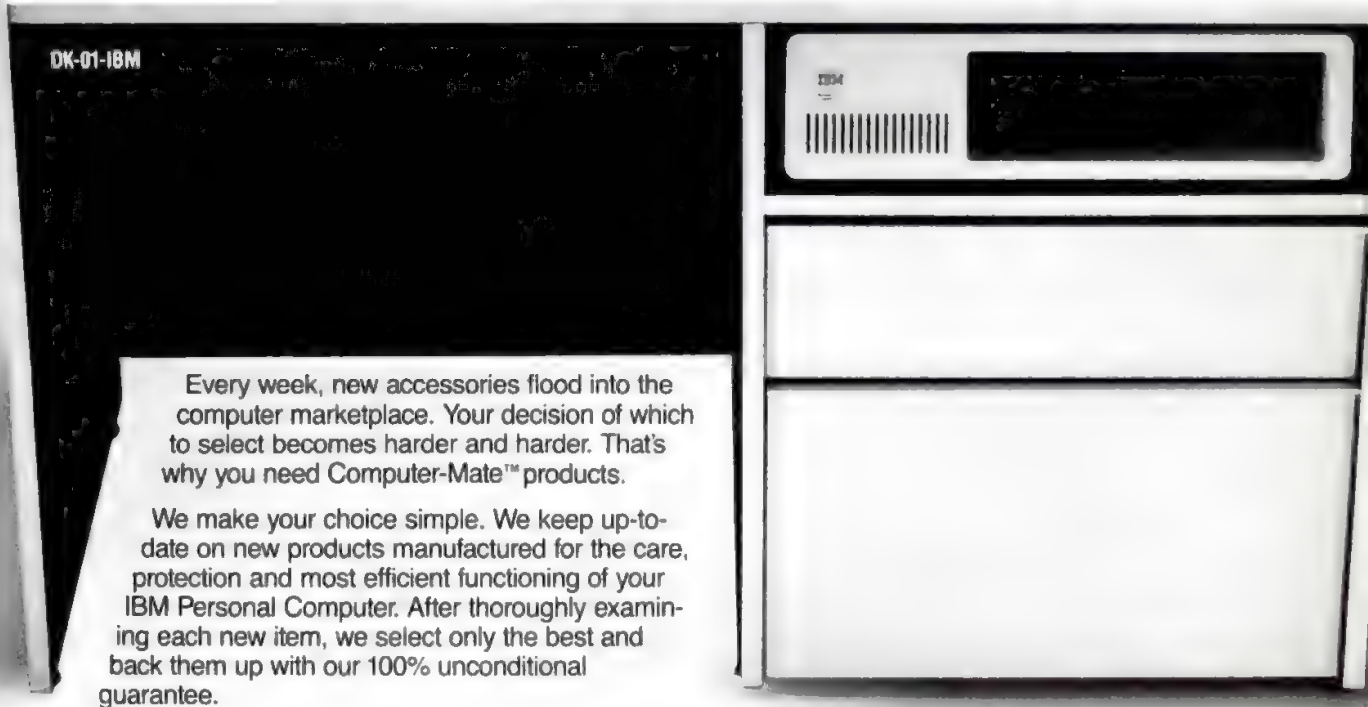
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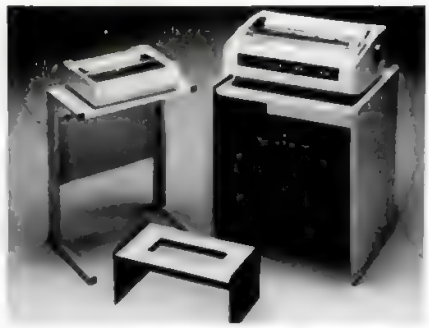
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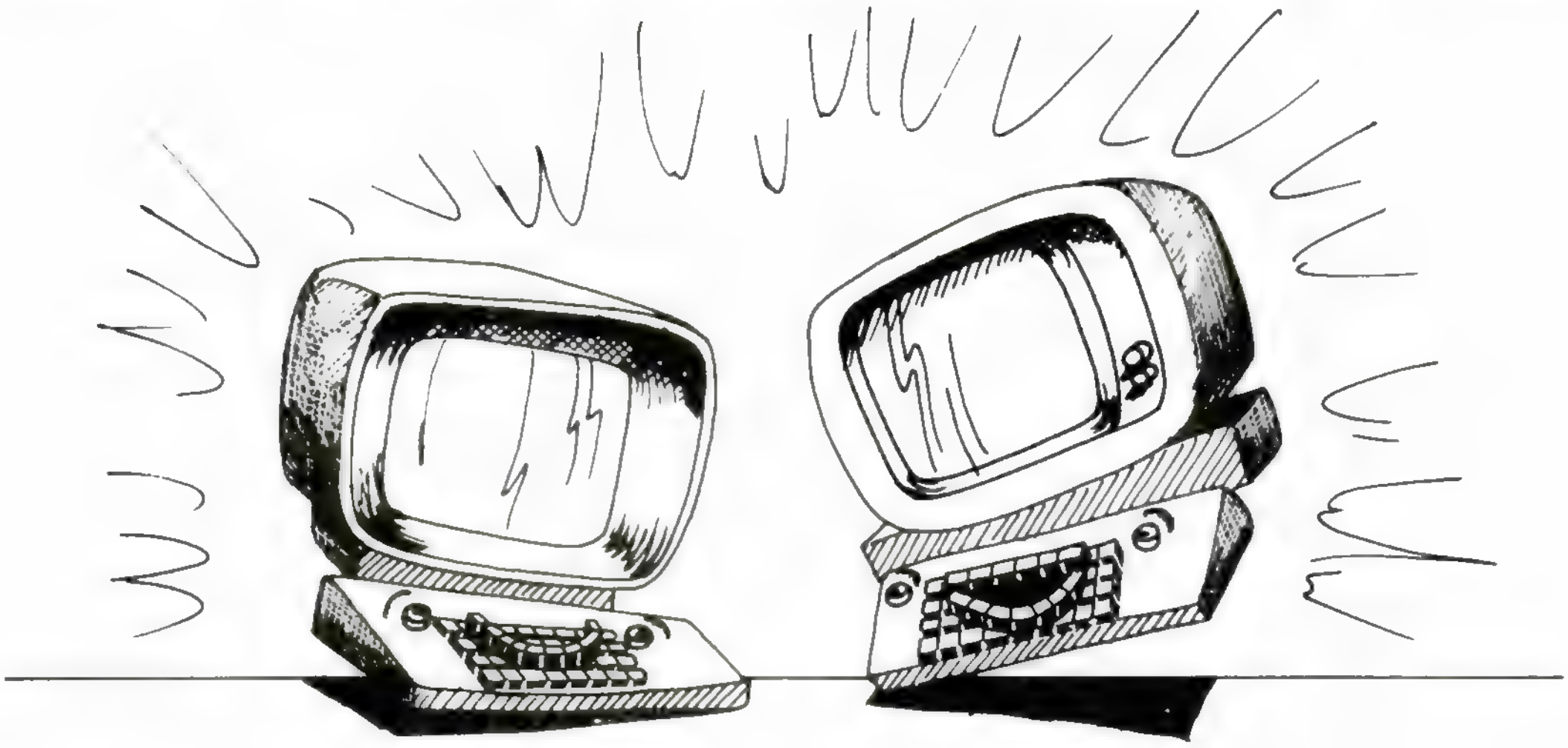
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Winning The Battle Of The Budget

An operative spreadsheet plan that incorporates a budget for your spending and a balance for your statements.



Illustration: Burrell Dickey



Do you find yourself living from paycheck to paycheck? Do the debts pile up no matter how hard you try to pay them off? Or are you one of the lucky people who does just fine—until you are torpedoed by that semiannual insurance bill, tax bill, or vacation? If the mechanics of running your financial life are taking too much of your time and energy, consider using your personal computer to establish a personal budget.

A personal budget can't solve all financial problems, but it is the best way to get started on the road to financial health. The PC can be a great aid in establishing and monitoring that budget. After you have learned the basic principles of budgeting, you can set up and maintain a budget by using an electronic worksheet program.

Where to Begin

Before you consider how much to spend on food, housing, and vacations, you must know just how much money you have to work with. Many money problems arise because people assume their spendable income is greater than it really is. If you think you're earning $3,000 a month, but you actually take home $2,400, you're going to have problems making ends meet.

We often think of our salary as the gross amount we are paid but neglect to consider that Uncle Sam takes a healthy bite out of each paycheck before we see it. And it's worse if you're self-employed, because a sizable chunk of each fee, commission, or advance must be set aside for taxes.

The first thing to figure out is just what your spendable—after tax—income will be over the next 12 months. A year is a good planning period because it accounts for month to month variations and makes estimating your tax bill easier.

Begin by looking at a past pay stub; consider only your take-home pay. Then look for other sources of income: interest, dividends, capital gains, free-lance income, advances, fees, business earnings from self-employment. If you are married or share living expenses with someone and you want to make a joint budget, you will also need to consider that person's sources of income.

Once you know how much income you expect to receive for the year, you must subtract taxes on that part of your income not subject to withholding. (In general, that will be all income other than wages and salaries.)

Depending on your circumstances, you

may have to pay estimated taxes in quarterly installments; the Internal Revenue Service can tell you if you need to do this. These estimated taxes are money you won't be able to spend for goods and services, so you must reduce your expected income by an amount sufficient to meet them. Depending on your level of income and how much Social Security tax you must pay, this reduction can be 20 to 30 percent of your gross income not subject to withholding.

Table 3: Sample Budget

Monthly Budget for	OCTOBER 1982
Monthly Income	
Salary	1474.00
Interest	125.00
Dividends	76.00
Fees	375.00
Total	2050.00
Amount Budgeted	1875.00

Next, divide your projected after-tax income by 12. You will then have calculated the bottom line: a cold-blooded estimate of how much money you can spend each month. If you have never budgeted before, take a moment to congratulate yourself; it takes discipline and courage to get this far, and you have accomplished something important. Knowing how much money is available each month is a powerful tool for keeping your expenses in line.

Table 1: Fixed Expenses

- Savings
- Mortgage/Rent
- Utilities
 - Telephone
 - Heat
 - Electricity
 - Water
- Real Estate Taxes
- Income Taxes
- Insurance
 - Home
 - Life
 - Health
 - Automobile
- Debt Repayment
- Children's Allowance

Table 2: Variable Expenses

- Food
- Clothing
- Gasoline
- Entertainment
- Repairs/Upkeep
 - Automobile
 - Home
 - Appliances
- Books/Magazines
- Charities/Contributions
- Birthdays/Christmas
- Hobbies
- Vacation
- Liquor
- Household Supplies
- Contingencies/Walking-Around Money

Table 3: Sample Budget

FIXED EXPENSES	INCOME	EXPENSE	MO BALANCE	Y-T-D BALANCE
SAVINGS				
Y-T-D Balance Forward	500.00			
Monthly Budget Amount	50.00			
Monthly Balance			50.00	
Year-To-Date Balance				550.00
MORTGAGE				
Y-T-D Balance Forward	0.00			
Monthly Budget Amount	A 600.00	C		
October Payment	↓	↓ 600.00		
Monthly Balance	B	D	E 0.00	
Year-To-Date Balance				0.00
HOME INSURANCE				
Y-T-D Balance Forward	F 63.75	H		
Monthly Budget Amount	31.88			
Annual Payment	↓	↓ 382.50		
Monthly Balance	G	I	-350.62	
Year-To-Date Balance				J -286.87
AUTO INSURANCE				
Y-T-D Balance Forward	114.00			
Monthly Budget Amount	29.20			
Monthly Balance			29.20	
Year-To-Date Balance				143.20
HEALTH INSURANCE				
Y-T-D Balance Forward	455.52			
Monthly Budget Amount	75.92			
Monthly Balance			75.92	
Year-To-Date Balance				531.44
UTILITIES				
Y-T-D Balance Forward	128.17			
Monthly Budget Amount	95.00			
October Payment		146.36		
Monthly Balance			-51.36	
Year-To-Date Balance				76.81
PROPERTY TAX				
Y-T-D Balance Forward	110.00			
Monthly Budget Amount	110.00			
Monthly Balance			110.00	
Year-To-Date Balance				220.00
FOOD				
Y-T-D Balance Forward	0.00			
Monthly Budget Amount	338.00			
Transfer to Checking		338.00		
Monthly Balance			0.00	
Year-To-Date Balance				0.00

The Budget

A budget allocates spendable income among various categories of expenses. It is usually divided into two parts. Fixed expenses are unavoidable, contractual obligations such as insurance premiums, mortgage or rent, car payments, and property taxes. Variable expenses are day to day expenditures for items such as food, clothing, and recreation.

The distinction between fixed and variable expenses is not hard and fast. It is intended to show which expenses are predictable and which can be easily adjusted. Fixed expenses are set—often to the penny—and are easy to predict, but they can be adjusted slowly with changing circumstances. Altering your monthly mortgage payment would probably require selling your home; spending more or less on clothing is much easier to do.

Fixed Expenses

While most fixed expenses are determined by contract, the most important fixed expense is not—the amount you set aside for personal savings. Whatever you decide to save, take it out first. Pay yourself before you pay any other bills. Savings are your rainy day reserve and your investment source.

If you are going to use your savings to build a retirement nest egg, you should investigate an Individual Retirement Account (IRA) to accumulate tax-free returns while reducing your current income tax liability. Most savings and loan associations, banks, and other financial institutions can give you information on IRAs.

A budget can keep you from being unprepared to meet large bills for insurance and property taxes or regular expenses for birthdays, Christmas, and vacations. Simply make an estimate of your annual commitment, divide by 12, and budget that amount each month. Then you'll be ready when the bills or the big events arrive.

Table 1 contains a list of typical fixed expenses. Use it as a guide when you prepare your own budget.

Table 3 Sample Budget

FIXED EXPENSES	INCOME	EXPENSE	MO BALANCE	Y-T-D BALANCE
CLOTHING				
Y-T-D Balance Forward	-98.32			
Monthly Budget Amount	50.00			
Macy's Charge Card		75.20		
Monthly Balance			-25.20	
Year-To-Date Balance				-123.52
GASOLINE				
Y-T-D Balance Forward	-8.76			
Monthly Budget Amount	35.00			
Gas Credit Card		28.92		
Monthly Balance			6.08	
Year-To-Date Balance				-2.68
AUTO REPAIRS				
Y-T-D Balance Forward	-185.20			
Monthly Budget Amount	15.00			
Monthly Balance			15.00	
Year-To-Date Balance				-170.20
HOME REPAIRS				
Y-T-D Balance Forward	315.00			
Monthly Budget Amount	45.00			
Plumber		82.50		
Monthly Balance			-37.50	
Year-To-Date Balance				277.50
GIFTS				
Y-T-D Balance Forward	176.50			
Monthly Budget Amount	25.00			
Mom's Birthday		35.28		
Monthly Balance			-10.28	
Year-To-Date Balance				166.22
VACATION				
Y-T-D Balance Forward	325.00			
Monthly Budget Amount	75.00			
Monthly Balance			75.00	
Year-To-Date Balance				400.00
CONTINGENCIES				
Y-T-D Balance Forward	-17.20			
Monthly Budget Amount	300.00			
Transfer to Checking		298.00		
Monthly Balance			2.00	
Year-To-Date Balance				-15.20
TOTALS		**1986.76**	**-111.76**	**1766.70**

Variable Expenses

Variable expenses are the items you buy every day, things over which you can exercise a substantial degree of control (see Table 2 for examples). This is the first place to look if you need to reduce spending. It is also where you are most likely to exceed your budget. Don't panic if you overspent on entertainment this month. Your budget will tell you how much you are in the hole, so you can be a bit more frugal in the future.

A good budgeting guideline is to avoid worrying too much if you overspend in a particular category, as long as your spending for the month doesn't exceed your overall ceiling. You can use the money allocated, but not spent for other items, to cover overexpenditures. If your spending goes above the budget for variable expenses, or if you consistently overspend in one or two categories, you should adjust the amounts allocated for your budget items and make a serious effort to curb your spending.

One compensation for occasional overspending is a "contingency fund." This is a category of unassigned funds intended to cover unanticipated expenses or overspending. When you first begin budgeting, make the contingency fund fairly large—

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15 to 20 percent of your total budget. As you fine tune your allocations, you can reduce the contingency fund, ideally adding that extra money to your savings or investment program.

When you first prepare a budget, you will have to decide how much to spend in each category. The easiest way is to study your receipts and check stubs, and use a 12-month average as a basis for beginning your budget. In time you'll refine the categories and adjust the budget to reflect your actual spending pattern.

An Example

An electronic spreadsheet program is an ideal tool for creating and maintaining a personal budget. The information can be customized for your particular needs, stored on a disk, and recalled whenever you want it. An example of a budget prepared on an electronic worksheet is shown in Table 3. This budget can serve as a model for the one you devise with any PC-compatible spreadsheet program. Although commands and formulas vary from one program to another, the principles for establishing a spreadsheet budget do not vary. The following discussion of the sample budget describes the calculations needed in each major portion of the worksheet. You can adapt these general formulas to the specific requirements of your program and your financial situation.

Setting Up the Worksheet

At the top of Table 3 are the income items and the total amount budgeted for the month of October ($1,875). The budget in the main body of the table is divided into Fixed Expenses and Variable Expenses. These are further subdivided into categories (Savings, Mortgage, and so on) and monthly dollar amounts budgeted for each: $50 for savings, $600 for mortgage payments, and $63.75 for home insurance.

The dollar amounts are arranged into four columns: Income, Expenses, Mo Balance (Monthly Balance), and Y-T-D Balance (Year-to-Date Balance).

In the Income column the first entry in each category is the Balance Forward from the preceding month. If the Balance Forward is positive, you have unspent funds from previous months. If it is negative, as it is under Contingencies in Table 3, you have overspent your budget. The second entry is the amount you have budgeted for the month. These two items show how much money you may spend for each category during the month.

The entries in the Expense columns are the payments you charge to each category during the month. If you think of each category as a separate bank account, the Income entries are deposits and the Expense entries are withdrawals.

The Monthly Balance column displays the balance of the transactions made during the month for each category. Since it summarizes only the activity for the month in question (October in this example), it must exclude the Balance Forward from preceding months. It is like the monthly summary in a checking account; checks cleared (Expenses) are subtracted from deposits made during the month (Income excluding Balance Forward). If the Monthly Balance is positive, you've spent less than your budget. If the balance is negative, you have overspent; if it is zero, your expenses have just equaled the monthly budget.

ALTHOUGH commands and formulas vary from one program to another, the principles for establishing a spreadsheet budget do not.

Entries in the Year-To-Date Balance column show how closely your budget matches your expenses over time. It is calculated by subtracting Expenses in each category from the sum of the items in Income (including Balance Forward). The Year-to-Date Balance is like the current balance in a checking or savings account, whereas the beginning balance (Balance Forward) shows increases by the month's deposits and reductions by withdrawals (Expenses). At the end of each month, the entry in the Year-to-Date Balance column is carried over to the following month as the Balance Forward.

Formulas

The worksheet is constructed so that the Monthly Balances, Year-to-Date Balances, and totals at the bottom are calculated automatically. In Table 3 the letters A through J are reference points for the dis-



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cussion of these formulas. For additional clarity, these cells have also been outlined in the table. Regardless of which spreadsheet program you use, the example in Table 3 will serve as a model for the budget.

The Monthly Balance in the example is the sum of the Income items (excluding Balance Forward) minus the Expense items. The Monthly Balance example in Table 3 is marked as cell E. To calculate the amount of this balance, you must first establish the Income and Expense for the category involved (in this case Mortgage).

Note that A and B are located next to cells in the Income column of the table and that A shows $600 as the Monthly Budget Amount. Cell B is empty because it is not an Income item. It would be possible to establish a calculation formula for Monthly Balance (cell E) without labeling an empty cell as B, but by including this designation, you can specify a range of values as part of your formula, rather than using just the one number at cell A. This use of a range of values allows you to add an item between points A and B and not throw off either the calculation or the formula at a later time. As Table 3 shows, points C and D are treated as a range of values so that new items may be added without disturbing the calculations.

To determine the Monthly Balance of the Mortgage category in Table 3, you have to write only one formula at cell E. The formula computes the sum of the Income items, from cells A to B, minus the sum of the Expense items, from C to D. (To construct this formula, use the proper commands for your spreadsheet program and specify the appropriate range of values for each category.)

The Year-to-Date Balance is calculated in a manner similar to the Monthly Balance, but you include the Balance Forward. Under Home Insurance in Table 3, for example, the Year-to-Date Balance (cell J) equals the sum of the Income items from F to G (including Balance Forward) minus the sum of the Expenses items from H to I.

To set up the rest of the spreadsheet, copy the Monthly Balance and the Year-to-Date Balance formulas into the appropriate cells in each budget category. Be sure to respecify the range of summation each time you move to a new category.

Below the main body of the budget table are the summaries for the month. Each of these totals is simply the sum of the column above it.

Maintaining the Spreadsheet

An advantage of preparing your budget with a spreadsheet program is that you can use the spreadsheet's Insert function to add a line whenever you want to include a new item. Since you will be adding an item in the middle of a column being totaled, the range of the addition function will adjust automatically, thanks to the empty cells, B and G. Your budget sheet will not have unnecessary gaps, and it can expand to meet any degree of detail.

When you first prepare your budget, make a general template that contains labels for Balance Forward, Monthly Budget Amount, Monthly Balance, and Year-to-

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Date Balance. Then specify formulas for Monthly Balance, Year-to-Date Balance, and column totals in the appropriate cells. You can also enter the amount budgeted into the template under the Income column on the Monthly Budget amount line. When it comes time to do your budget, call up the template and enter the Balance For-

THE INTERNAL Revenue Service doesn't accept entries on a disk as valid tax records.

ward amounts for each category. These amounts will be available as the right-hand column of the previous month's budget. Your worksheet will then be ready to receive the current month's expenses.

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To manage your budget efficiently you will need a savings and a checking account. The amount you deposit in the savings account would be the excess of the amount budgeted over payments made for that month. In some months you will have to draw money out of savings to pay for certain large expenses. In the example in Table 3 the $382.50 paid out for home insurance in October is greater than the October contribution, so a withdrawal from savings is necessary to cover the expenses. At the end of the month the balance in the savings account should be the same (adjusted for interest payments) as the Total Year-to-Date Balance in the bottom line of Table 3. In the example it would be $1,766.70.

You will use the checking account to pay bills and as a place to keep funds for current expenses such as food and contingencies. Remember that the Internal Revenue Service doesn't accept entries on a disk as valid tax records, so be sure to keep copies of your receipts and cancelled checks. Also remember to keep your budget simple, updated, and modified as your financial situation changes. It should help you manage spending, reduce debts, and save for things you really want. **/PC**

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York Company	34569	80
GFD Corporation	1000	71
Ace Manufacturing Co.	87990	65
Applied Technologies	4567	61
M and Z Corporation	9000	50
Tyne Industries	7000	45
Advanced Systems	4390	28

NOTE Send reminders to all accounts overdue 60 days or more

Features

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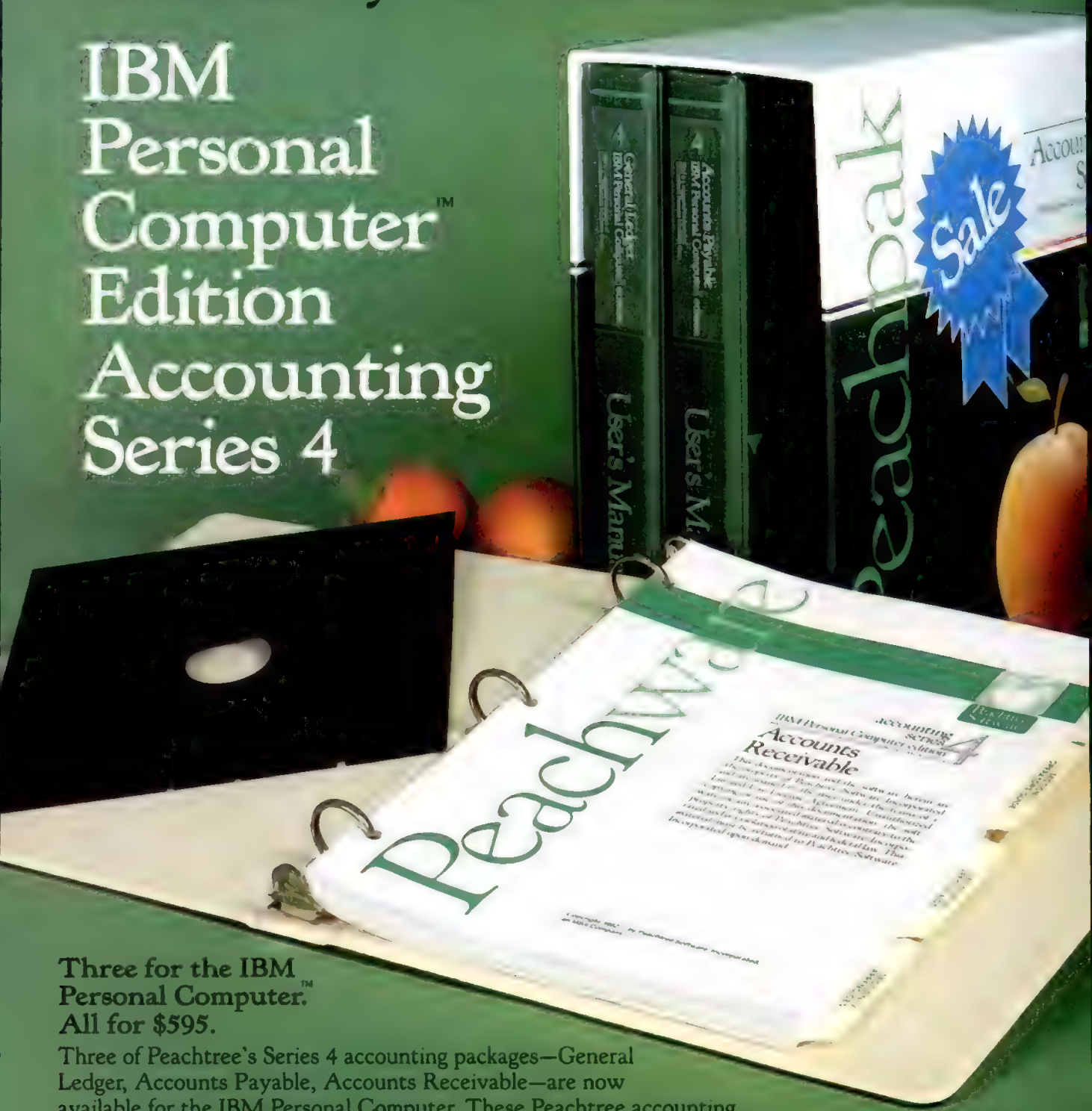
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EDUCATION/LINDA V. WILLIAMS

Kids Teach The Teachers

A unique exchange of roles—the teachers are teenagers, the students are teachers, and the subject is computers.

Three people huddle around an IBM PC. One is sitting at the keyboard typing in commands. Another glances back and forth between an instruction manual and the typist. The third focuses her attention on the monitor. The first two, seizing the moment, turn to the third and tentatively ask, "Are we ready?" "Let's try it," comes a breezy response. The typist inputs a final command. The word "Cheerios" and a rectangle appear side by side on the screen.

"How'd that happen? Why isn't the name in the box?" ask the two users, obviously perplexed. The spectator leans forward and patiently replies, "Let's go over it again and see what you did."

The spectator is a 14-year-old high school freshman; the users are elementary school teachers. Except in this case they are the students and the freshman is their teacher. Their roles have been reversed in an effort to demonstrate that just about anybody can learn to use microcomputers, and, equally important, just about anybody can learn to teach others how to use them.

The setting is Stanford University, where 40 teachers and administrators from as far away as Montana, Massachusetts, and even Switzerland gathered to participate in a 6-week summer institute, "Microcomputers in Education," jointly sponsored by Interactive Sciences, Inc. (ISI), a nonprofit corporation in Palo Alto, California, and the Stanford School of Education. ISI's purpose is to spread computer literacy through peer tutoring, shatter some of the myths attending the microcomputer revolution, and prepare users for revolutions to come.

Peer Tutoring

Peer tutoring, a concept older than the one-room schoolhouse, is an idea whose time has come again. ISI has updated it with its Computer Tutor Method, a system that promotes a chain reaction of learning. Upon completing a six-lesson course, each student is assigned two newcomers. When they complete the training, they too become tutors. The effect on computer literacy is exponential.

Joan Targ, president of ISI, views peer tutoring as uniquely suited to the challenge of teaching adults and children about microcomputers. She points out that in a field in which new students are often intimidated by complex technology, the presence of a peer rather than an expert can be reassuring. The machines become less awesome, and the tutors, by their example, demonstrate that anyone can master them.

When what you learn today may be out of date tomorrow, it's important to feel that you aren't dependent on experts. Peer tutoring helps establish confidence that you can learn by yourself and from others.

This approach has been particularly successful with girls, who are often intimidated by computer classes. In many schools and adult classes the majority of students are males, causing the few females to feel out of place. In public schools Targ makes a point of having girls tutor other girls. She schedules sessions so that they are not completely outnumbered by boys in the classroom. When Targ discovered that many students, especially girls, were insecure about their mathematical abilities, she decided to keep math-related programming to a minimum. One result of her efforts is that 40 percent of the computer students at Jordan Junior High in Palo Alto are girls.

Peer tutoring also offers some very practical advantages at a time when school budgets are being cut back. The use of tutors assures each learner individual attention and a high degree of flexibility in how he or she works through the material, while putting minimal demands on the adult teacher's time.

Computer neophytes are not the only ones to benefit. The tutors themselves



Adults and children learn about computers through peer tutoring.

learn and understand the material better as a result of teaching it. Each learner poses new questions or experiences different problems that force the tutor to reexamine the subject. Tutoring also bolsters confidence and helps promote language skills because students learn to express themselves clearly as part of the teaching process.

In the Palo Alto area adoption of the Computer Tutor Method has benefitted the larger community. ISI offers weekend scheduling for adults and those students whose schedules don't allow weekday classes. Senior citizens have taken the course and gone back to the local senior center to sponsor new classes. Many participants are parents who later serve as volunteer supervisors. They help keep school computer rooms open before and after class. Some have become interested in introducing computers at the elementary school level. Students now arrive at junior high ready to begin tutoring.

Shattering Myths

In one sense every newcomer to microcomputers is a peer. In the presence of what at first seems to be awesome technology old roles and identities diminish. Consequently, at Stanford this summer it was possible to assign young people to tutor their elders. The results shattered at least one myth that pervades our thinking regarding computer technology: Children learn to use computers more quickly than grown-ups.

The teenagers involved in the Stanford program, having tutored both age groups, were in a good position to compare the strengths and weaknesses of both. Several young tutors observed that adults ask more questions. They viewed this characteristic favorably. Ann Blais, an eighth-grader at Jordan Junior High in Palo Alto, noted that "grown-ups seem to want to know why, but basically, once they learn it, they remember better." Chris Thacker, a freshman at Palo Alto High School, believes that adults catch on more quickly. "Because they ask questions, they understand better so they can handle problems."

Peter Hoffman, also from Palo Alto High, was impressed by the adults' behavior. "They listened more carefully and didn't get rowdy." On the whole, the kids seemed to regard tutoring adults as not much different from working with other kids, belying the assumption that one age group suffers from irreversible handicaps when compared with the other.

The adult participants were uniformly enthusiastic. One admitted that it took some adjustment to accept that she didn't know as much as her 13-year-old tutor, but she praised his patience and ability. Another teacher who had never used a computer found it easier to learn from young people because she felt less hesitant to ask questions or admit her ignorance. The adults were pleased and relieved to discover that they were not, after all, too old to learn a new and important skill.

Anat Ben-Zvi of Geneva, Switzerland, recognized another benefit for teachers. She observed that they had all been put in a situation that had once been familiar but which most had forgotten. "We were reminded what it's like not to know something, to be afraid of something, how to feel in front of the unknown. Children are

The Computer Tutor

Kids and adults take turns at the computer.

The sunlit lobby of the Center for Educational Research at Stanford is the kind of space more often found in modern office buildings than in schools. With its carpets, comfortable furniture, and green plants, it reflects the cool serenity of the academic ivory tower. But on the July morning when I first visited ISI's institute on Microcomputers in Education, I found the lobby transformed into a combination classroom and computer camp. Tables laden with IBM PCs (30 of them donated by IBM for the institute) and an assortment of Apples, North Star Horizons, and Ataris filled the lobby. Eager teenagers in red T-shirts emblazoned with "Computer Tutor" joined equally eager adults around the machines.

* * *

One of my standard questions of the tutors was, "How do you use the computer for your school work?" Most tell of using it for math problems, writing programs to help them learn formulas, and using the word processor to write papers, but their real passion is clearly for free-time uses. Some invent their own games; some design graphics; and some like to make music. They describe collaboration with other students. One group, for example, programs a melody on one disk, harmony on another, bass on a third, and then plays the three disks at the same time.

The adults shared the same appreciation and cooperation. When one team solved a difficult problem, others gathered around to offer congratulations. "Will you print that program out on the word processor so I can have a copy?" The request was always greeted with a pleased, "Of course."

The assignment is to draw a rocket ship and make it take off by moving up the screen. Various teams have been working on the problem for quite a while. Suddenly a whoop issues from one group. "Look, everyone—come look! You can see the moon." Tutors and teachers gather around the monitor. Sure enough, the sun from the building's skylight is casting a shadow on the screen that takes the shape of a half-circle. As the rocket rises on the screen, it appears to be leaving a sphere. "Hey, the dust specks on the screen are like craters," someone notices. The rocket takes off again. Everyone applauds and eager teachers take me over to witness the event.

* * *

I asked the tutors how their work with computers had affected their ideas about a future career. One girl responded, "Well, first I thought I might want to be a doctor, and then I thought I might want to be a tennis player; now I think I might want to be a computer person. But I decided maybe I could be a doctor who plays tennis and has a computer."

* * *

The time is divided so that teachers work with kids for an hour, teachers have the computers to themselves for an hour, and finally the kids have the machines for an hour. Five minutes before the time appointed for the kids, the door to the room is crowded with teenagers leaning in, waving at teachers, and waiting—not too patiently—for them to leave. "It's always like that," groans one of the teachers. "They really want their time on the machines, and they let us know it. We understand, because we don't want to leave." —*L.V.W.*

in this situation very often. It was good to remind us how to be in their place."

Accommodating Change

The material tutors teach will be obsolete in 3 to 5 years—or sooner. The speed with which change occurs in the computer field poses a challenge to educators whose goal is computer literacy. The institute's staff approached this problem in several ways. First, by using student-tutors, they introduced participants to a method of teaching that could be adopted by any school, and that has the capacity to accommodate rapid change. Second, the staff gave adult participants an opportunity to work on several types of microcomputers besides the PC. Finally, the program leaders introduced participants to experts in all areas of the computer field to give them an overview of present and future directions in computer technology.

TUTORING bolsters confidence and helps promote language skills.

Many teachers attending the institute would return to their school districts as advocates of the teaching methods they had learned at Stanford. Computer teaching methods need computers. To help prepare the teachers for the hardware decisions that may await them on the homefront, the ISI staff encouraged them to think ahead.

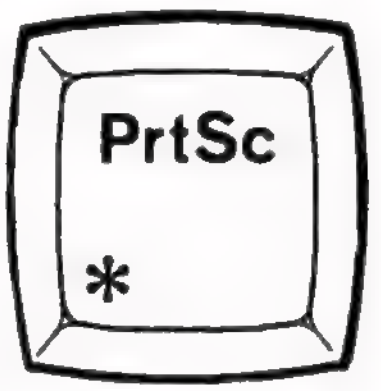
Jeff Levinsky, vice president of ISI, compares some apparently inexpensive computers to Barbie dolls: "You buy one; you discover you don't have enough; and you have to keep going out and buying accessories just to have anything interesting. It's worse than a Barbie doll, because you absolutely need them. The tempting come-on price is illusory."

Levinsky is eager to save educators from the Barbie doll blues. He urges teachers and others buying computer equipment to plan for the future when they make computer choices and to look at a system's potential when evaluating whether it is a good buy. A system that seems to be a bargain because of its low initial price may end up costing more than

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21

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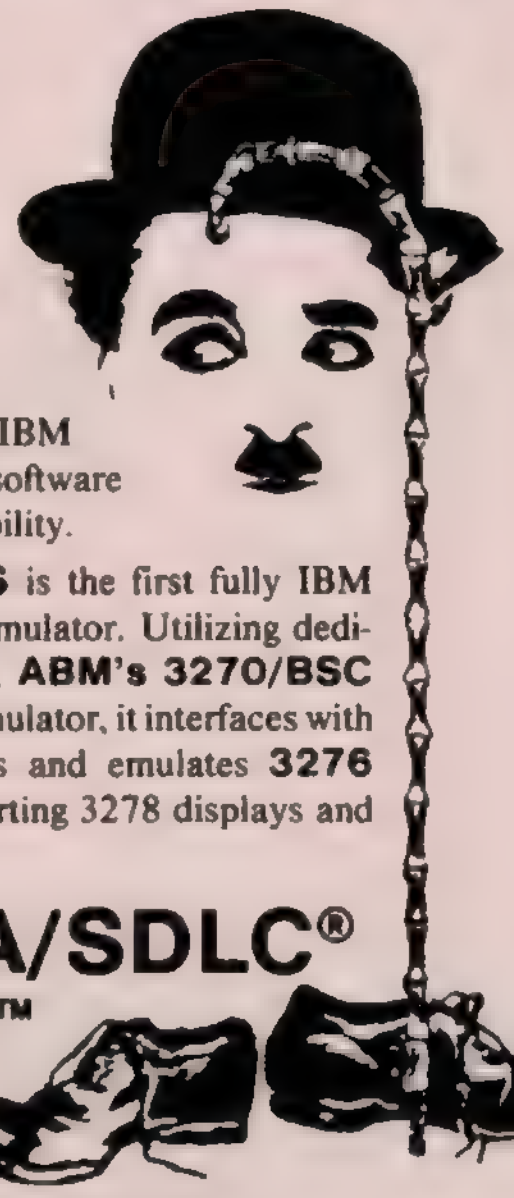
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others when the time comes to upgrade. He warns that it may not even be possible to upgrade an existing system to perform new tasks.

In his survey of different systems, Levinsky concludes that the PC is well adapted for upgrading. It not only possesses features such as standard word processing,

THE TUTORS learn and understand the material better as a result of teaching it.

graphics, and music (all of which have the power to motivate students), but its additional memory capacity makes it potentially useful as a multitasking system.

Gazing Into the Silicon Ball

ISI's location in the heart of Silicon Valley provides unique opportunities for educators. Developments discussed casually over lunch in industrial parks may take years to come to the attention of teachers just a few miles away. Yet knowledge of technological advances may provide powerful advantages for educators trying to determine the best ways to use microcomputers in their schools. Joan Targ, Jeff Levinsky, and Decker Walker of Stanford's graduate program in Interactive Educational Technology have designed their program to enable participants to establish and maintain computer programs in their schools. They also encourage them to become ongoing resources for their school districts and communities. To accomplish this the ISI staff has drawn on the wealth of resources available around them.

The educators visited Hewlett-Packard to study the design of microchips. They visited Xerox's Learning Research Group and the Control Data Corporation to learn more about the PLATO learning system. At the Stanford campus ISI provided access to computer music, graphics, alternative languages, word processing, networking, computer-assisted instruction, artificial intelligence, robotics, and applications for the handicapped.

The institute brought everybody back

to earth when a panel of experts came in to discuss the means of convincing the powers that be to commit resources for computer literacy programs. Members of the panel, including Bob Rowe of IBM, Alan Kay of Atari, and Jacques Vallee of Info-Media, stressed that microcomputer applications in education are not always apparent or practical.

Joan Targ cited the example of word processing. She noted that only a few years ago applications of word processing to education were not even discussed, because the cost of equipment was beyond the means of school districts. She and her colleagues at ISI nonetheless recognized word processing's potential for improving language arts skills and began exploring possibilities. As a result of their early work they are prepared to evaluate and take advantage of the new, less costly equipment and software that schools can afford. They are off and running with a program that uses word processing to improve writing skills.

"Thinking ahead is essential," Targ asserts, "because anything that's out of the reach of a school right now may be within reach in a short time."

When asked to comment on the summer institute and ISI's other projects, Targ explained, "Challenge is opportunity. We're dealing with change; we're looking for a way to help kids and people in general understand that change is really here. We want them to become self-starters and learners. This is not merely something that's happening in schools; it's society wide."

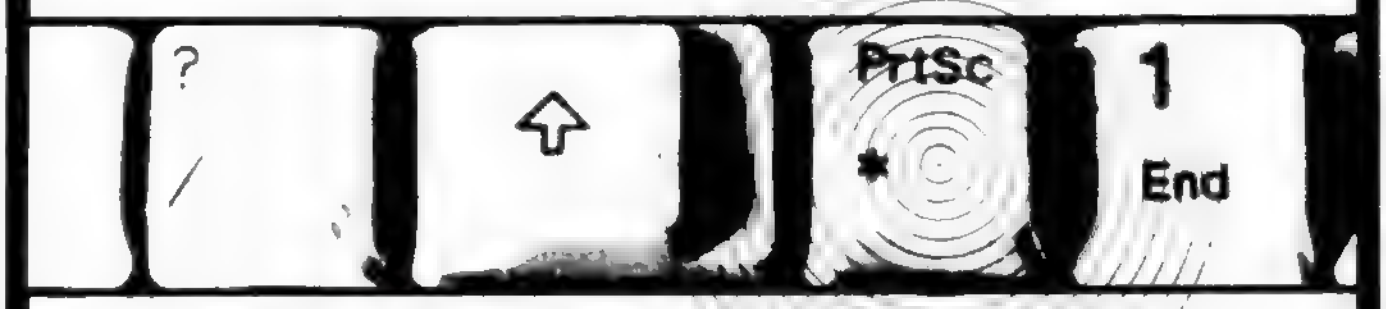
The Swiss teacher, Anat Ben-Zvi, offered another assessment: "You have it all right here. This is wonderful." */PC*

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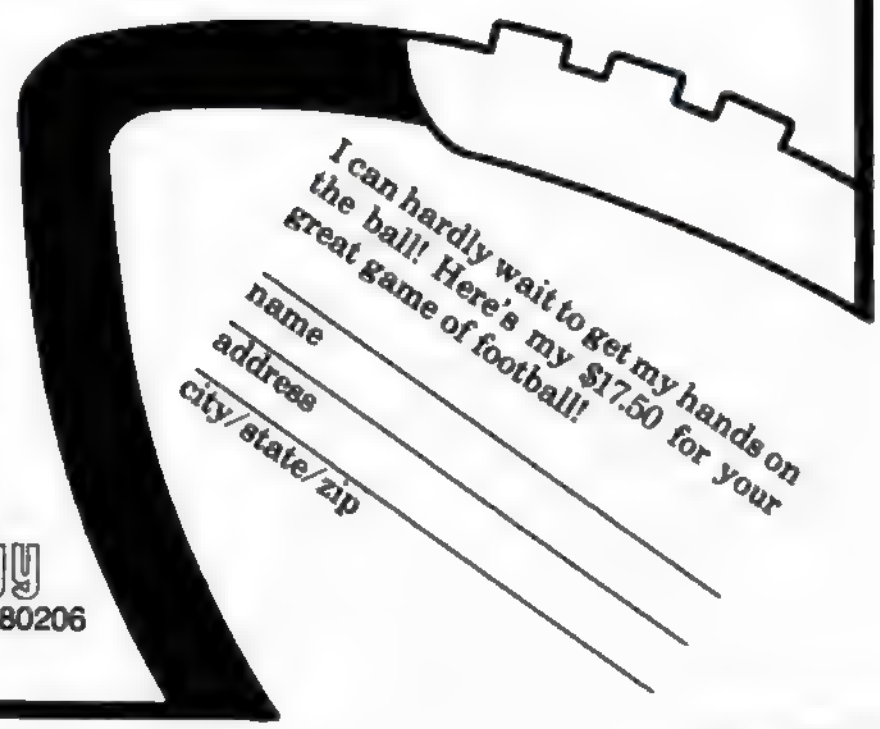
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2	ANNU1	Annuity computation program
3	DATE	Time between dates
4	DAYYEAR	Day of year a particular date falls on
5	LEASEINT	Interest rate on lease
6	BREAKEVN	Breakeven analysis
7	DEPRSL	Straightline depreciation
8	DEPRSY	Sum of the digits depreciation
9	DEPRDB	Declining balance depreciation
10	DEPRDDB	Double declining balance depreciation
11	TAXDEP	Cash flow vs. depreciation tables
12	CHECK2	Prints NEBS checks along with daily register
13	CHECKBK1	Checkbook maintenance program
14	MORTGAGE/A	Mortgage amortization table
15	MULTMON	Computes time needed for money to double, triple, etc.
16	SALVAGE	Determines salvage value of an investment
17	RRVARIN	Rate of return on investment with variable inflows
18	RRCONST	Rate of return on investment with constant inflows
19	EFFECT	Effective interest rate of a loan
20	FVAL	Future value of an investment (compound interest)
21	PVAL	Present value of a future amount
22	LOANPAY	Amount of payment on a loan
23	REGWITH	Equal withdrawals from investment to leave 0 over
24	SIMPDISK	Simple discount analysis
25	DATEVAL	Equivalent & nonequivalent dated values for oblig.
26	ANNUDEF	Present value of deferred annuities
27	MARKUP	% Markup analysis for items
28	SINKFUND	Sinking fund amortization program
29	BONDVAL	Value of a bond
30	DEPLETE	Depletion analysis
31	BLACKSH	Black Scholes options analysis
32	STOCVAL1	Expected return on stock via discounts dividends
33	WARVAL	Value of a warrant
34	BONDVAL2	Value of a bond
35	EPSEST	Estimate of future earnings per share for company
36	BETAALPH	Computes alpha and beta variables for stock
37	SHARPE1	Portfolio selection model-i.e. what stocks to hold
38	OPTWRITE	Option writing computations
39	RTVAL	Value of a right
40	EXPVAL	Expected value analysis
41	BAYES	Bayesian decisions
42	VALPRINF	Value of perfect information
43	VALADINF	Value of additional information
44	UTILITY	Derives utility function
45	SIMPLEX	Linear programming solution by simplex method
46	TRANS	Transportation method for linear programming
47	EOQ	Economic order quantity inventory model
48	QUEUE1	Single server queueing (waiting line) model
49	CVP	Cost-volume-profit analysis
50	CONDPROF	Conditional profit tables
51	OPTLOSS	Opportunity loss tables
52	FQUOQ	Fixed quantity economic order quantity model
53	FQEOWSH	As above but with shortages permitted
54	FQEOQPB	As above but with quantity price breaks
55	QUEUECB	Cost-benefit waiting line analysis
56	NCFANAL	Net cash-flow analysis for simple investment
57	PROFIND	Profitability index of a project
58	CAP1	Cap. Asset Pr. Model analysis of project
59	WACC	Weighted average cost of capital
60	COMPBAL	True rate on loan with compensating bal. required
61	DISCBAL	True rate on discounted loan
62	MERGANAL	Merger analysis computations
63	FINRAT	Financial ratios for a firm
64	NPV	Net present value of project
65	PRINDLAS	Laspeyres price index
66	PRINDPA	Paasche price index
67	SEASIND	Constructs seasonal quantity indices for company
68	TIMETR	Time series analysis linear trend
69	TIMEMOV	Time series analysis moving average trend
70	FUPRINF	Future price estimation with inflation
71	MAILPAC	Mailing list system
72	LETWRT	Letter writing system-links with MAILPAC
73	SORT3	Sorts list of names
74	LABEL1	Shipping label maker
75	LABEL2	Name label maker
76	BUSBUD	DOME business bookkeeping system
77	TIMECLCK	Computes weeks total hours from timeclock info.
78	ACCTPAY	In memory accounts payable system-storage permitted
79	INVOICE	Generate invoice on screen and print on printer
80	INVENT2	In memory inventory control system
81	TELDIR	Computerized telephone directory
82	TIMUSAN	Time use analysis
83	ASSIGN	Use of assignment algorithm for optimal job assign.
84	ACCTREC	In memory accounts receivable system-storage ok
85	TERMSPAY	Compares 3 methods of repayment of loans
86	PAYNET	Computes gross pay required for given net
87	SELLPR	Computes selling price for given after tax amount
88	ARBCOMP	Arbitrage computations
89	DEPRSF	Sinking fund depreciation
90	UPSZONE	Finds UPS zones from zip code
91	ENVELOPE	Types envelope including return address
92	AUTOEXP	Automobile expense analysis
93	INSFILE	Insurance policy file
94	PAYROLL2	In memory payroll system
95	DILANAL	Dilution analysis
96	LOANAFFD	Loan amount a borrower can afford
97	RENTPRCH	Purchase price for rental property
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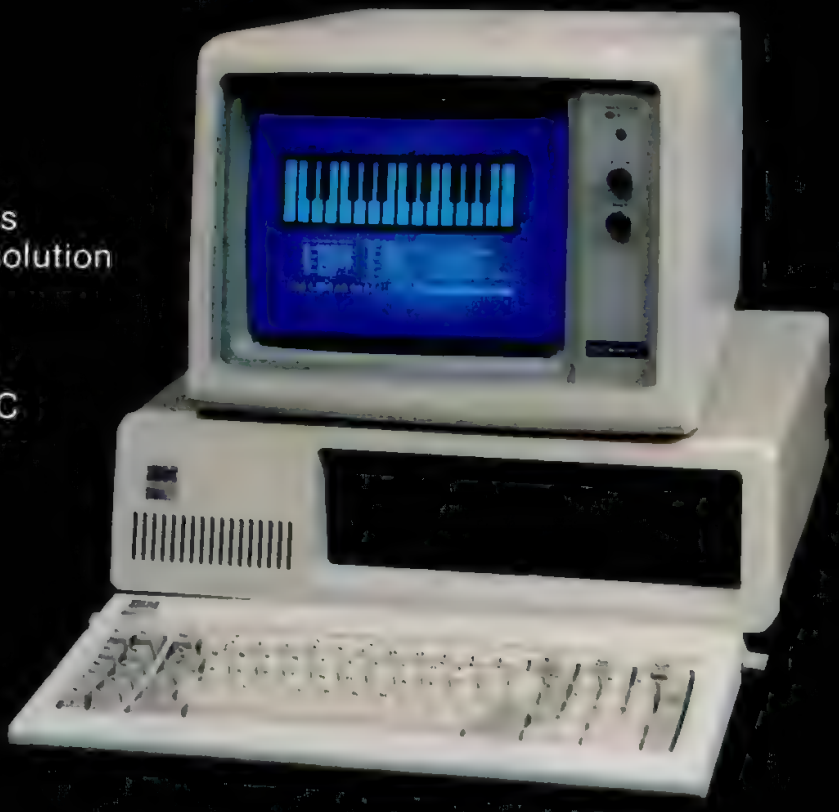
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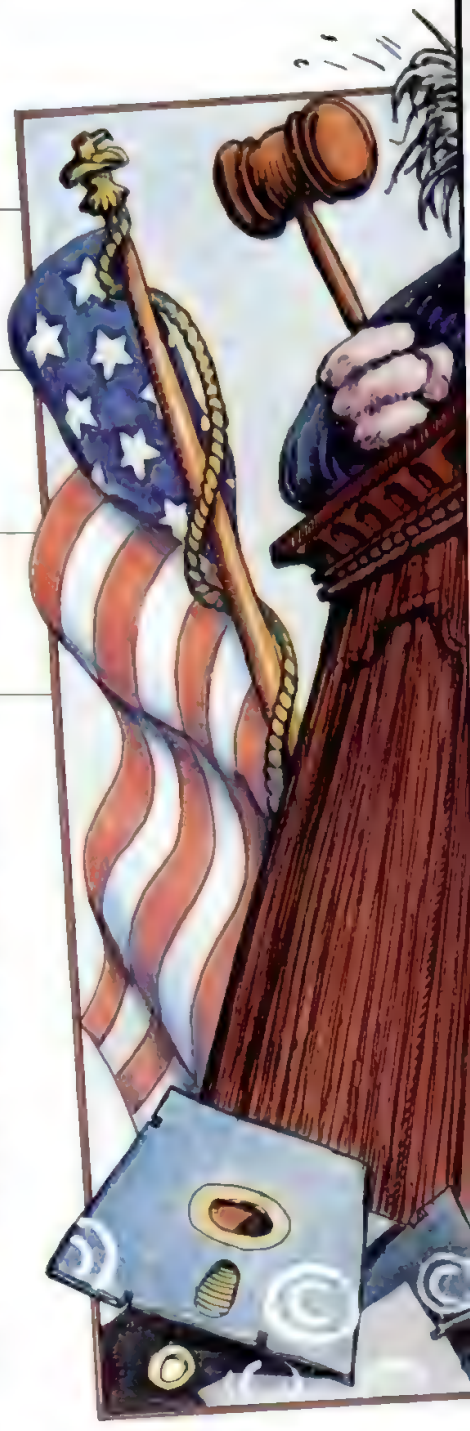
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Attorney Daniel Remer offers legal counsel to protect your programs from piracy—Part One.

How To Copyright Your Software



Part One of this three-part series explains what a copyright is and tells you how to put the proper copyright notice on your programs. Part Two details procedures for filling out the Copyright Office forms to ensure that you get the most protection from your copyright, and Part Three explores some of the enforcement provisions available to registered copyright owners. The focus is on practicality rather than the metaphysics of copyright protection.

For over a year the press has been hollering about software piracy. All seem to agree that no magic solution is at hand. Writers have advocated cures ranging from hardware locks to special legislation. In the meantime almost everyone who has published a program is looking to copyright law for protection. Most articles concentrate on the weaknesses inherent in using copyright law to protect software. Without minimizing these problems, this series sticks to down to earth, step by step instructions on qualifying for copyright protection. After all, if you haven't properly registered your software with the U.S. Copyright Office, you can't begin to take advantage of copyright law (17 USC 411).

A copyright is a bundle of rights that enable you to control the copying, licensing, manufacturing, sale, and use of your software. With a copyright you can license software publishers to publish your program. You can even split your copyright so that one publisher can market programs on one computer and others on different computers. You may sell, give, or will your copyright to someone. Besides using your copyright as a means of controlling distribution, you can use it to discourage piracy. Part Three of this series explores this issue in detail. Keep in mind that despite bad press, copyright law is being used successfully to thwart pirates from selling and importing copied software.

It is important to understand from the outset that a copyright does not protect your ideas, algorithms, program name, or company name. What it does protect is the expression of your program.

What do I mean by expression? Suppose you decided to write a word processing program that incorporates a unique feature. You could not copyright this feature even if it were original. However, the actual program lines that cause the feature to execute can be copyrighted. No one can copy these lines without your permission, but as long as someone does not copy, he or she can write a program that does the same things as your program without violating your copyright.

What Can Be Copyrighted?

Copyright law protects ownership rights of such things as program source codes, teletex transmission programs, electronic video game graphics, and technical drawings if they meet two criteria. To



qualify for copyright registration your program must be an act of original authorship—17USC102(a). It need not be unique, however. Most programs will meet this criterion. The original authorship requirement has been satisfied by such seemingly unoriginal items as lamp posts and data bases. What the Copyright Office is looking for is a work that itself has not been copied.

The next requirement is that the program be fixed in a tangible medium of expression. The program must be more than an idea or a brilliant inspiration; it must be in writing, on floppy, or on tape. Lawyers argue about whether a program in ROM fits the bill. While this is an interesting question with good arguments on both sides, it is not an issue for the purposes of this article. Let's assume your program meets the original authorship require-

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ments. Registration costs only $10. So we'll cover all the bases, and when you have done your best to comply with the copyright law, we can talk about philosophy.

A copyright is not difficult to get. Every work of original authorship is born with a copyright. To avoid losing your inherent copyright, you should do two things: Make sure every copy of your program has the proper copyright notice and register your program with the Copyright Office.

EVERY work of original authorship is born with a copyright.

The Notice

Every copy of your program should include a notice in the following form: (c) 198_ Your Name. You may also use any of the following variations and still be in compliance with the law: Copyright 198_ Your Name; Copr. 198_ Your Name; or (c) Copyright 198_ Your Name.

Other formulas will work, but I recommend the first example. If your program has sales potential abroad, include the phrase, "All Rights Reserved."

The law requires that you use the year of the program's publication. The word "publication" in copyright law means the year the program was first made available for distribution. Don't use the date the program was completed or the date it was manufactured unless these dates happen to coincide with the year the program was first made available for distribution. Once you have selected the correct date, it remains the same, year after year, unless the program is rewritten.

The correct name to use in the notice is the name of the copyright claimant, who may or may not be the programmer. If the program is a work for hire, the claimant's name will be the name of the company or individual who did the hiring.

What constitutes a work for hire can be confusing. This article will not explore the potential problems associated with works for hire. If you question who "owns" the program, consult a lawyer.

If there is more than one copyright claimant, you may wish to list only one claimant's name on the notice. When you file the registration, you can include all claimants' names on the certificate. Naturally, if you have a joint copyright you should have a written agreement specifying what each claimant's rights and responsibilities are to the other claimants.

The copyright notice should appear on the diskette label, on the screen when the program boots, at the beginning of the program's printouts, and at the end. It doesn't hurt to sprinkle the notice throughout the program as well. This pertains to each copy of the program. What is most important is that the notice be easily visible.

Notice Problems

I've often observed the following notice on software labels: (c) Name. This sort of notice will not protect your software. The Copyright Office treats notices without dates as if they didn't exist at all.

What if your notice was omitted altogether from some or all of your programs? The good news is you don't immediately lose your copyright. A few years ago it was relatively easy to lose a copyright through carelessness. One small slip and your work entered the public domain. Fortunately, the law has become more forgiving. If the notice has been omitted from only a relatively small number of copies, or if you register with the Copyright Office within 5 years of the publication without notice and a reasonable effort is made to add notice to all copies distributed without it, your copyright will be intact.

The bad news is that until you remedy the omission, someone may get away with copying your program. In this case you must send the copier the corrected notice. You must also take reasonable steps to fix the notice on released as well as future copies.

Registration

While the current copyright law seems to make the act of registration voluntary, a closer examination reveals that those who fail to register a program within 3 months of publication lose some important legal remedies. These include statutory damages and recovery of attorney fees. You

Warding Off Pirates

Although the Copyright Law requires that you use a simple "(c) 198_ Your Name" notice, most software writers and publishers also include a stern warning to potential pirates. I recommend the warning read something like this:

WARNING

This software (and manual) are both protected by U.S. Copyright Law (Title 17 United States Code). Unauthorized reproduction and/or sales may result in imprisonment of up to 1 year and fines of up to $10,000 (17 USC 506). Copyright infringers may be subject to civil liability.

There are two reasons for inserting this strong warning. The first is to try to discourage what I call "Piranha piracy." Individually piranha pirates don't present much of a threat, but as a group their nibbling can cause serious damage. The typical piranha may be a 12-year-old who copies for fun or a hobbyist who needs one more program for his collection. In most cases piranhas don't sell copies for profit. By including a stern warning, you are reminding these casual copiers that they are breaking the law. True, it won't stop everyone; it might not stop more than a handful. But every bit helps.

The warning also puts profiteering pirates on notice. If someone is selling copies of your program, you want to eliminate any opportunity for that pirate to say, "Gee, I didn't know how serious this copying could be." A court is going to have less compassion toward a pirate who was warned that copying is a serious criminal offense than toward someone who can plead ignorance.

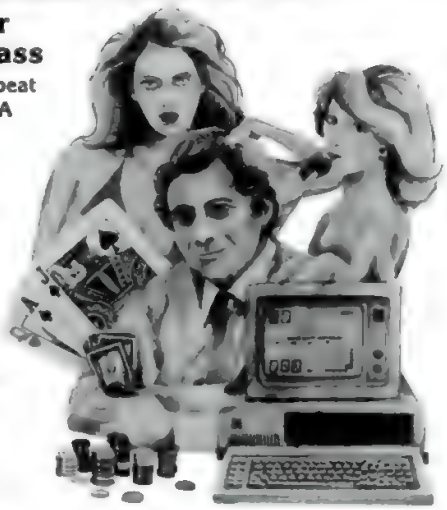
Many software publishers include a so-called software license. This license attempts to limit the use of the program to one machine and often attempts to limit the liability of the publisher toward the purchaser. End-user licenses deserve an article of their own. I have grave doubts as to whether they are legally valid. In fact, an improperly drawn end-user license can end up creating certain consumer warranties instead of eliminating them. So proceed with caution before copying some other publisher's (including IBM's) end-user license agreement.

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To begin the registration process, send a request to the Copyright Office for Form TX. If you wish to register a game, ask for form VA as well. Write to the Copyright Office, Library of Congress, Washington, D.C. 20559. If you are in a hurry, you may call (202) 287-8700 after 5 p.m. EST. An answering machine will ask you to state how many of each form you require. The second article in this series will discuss registration in greater detail.

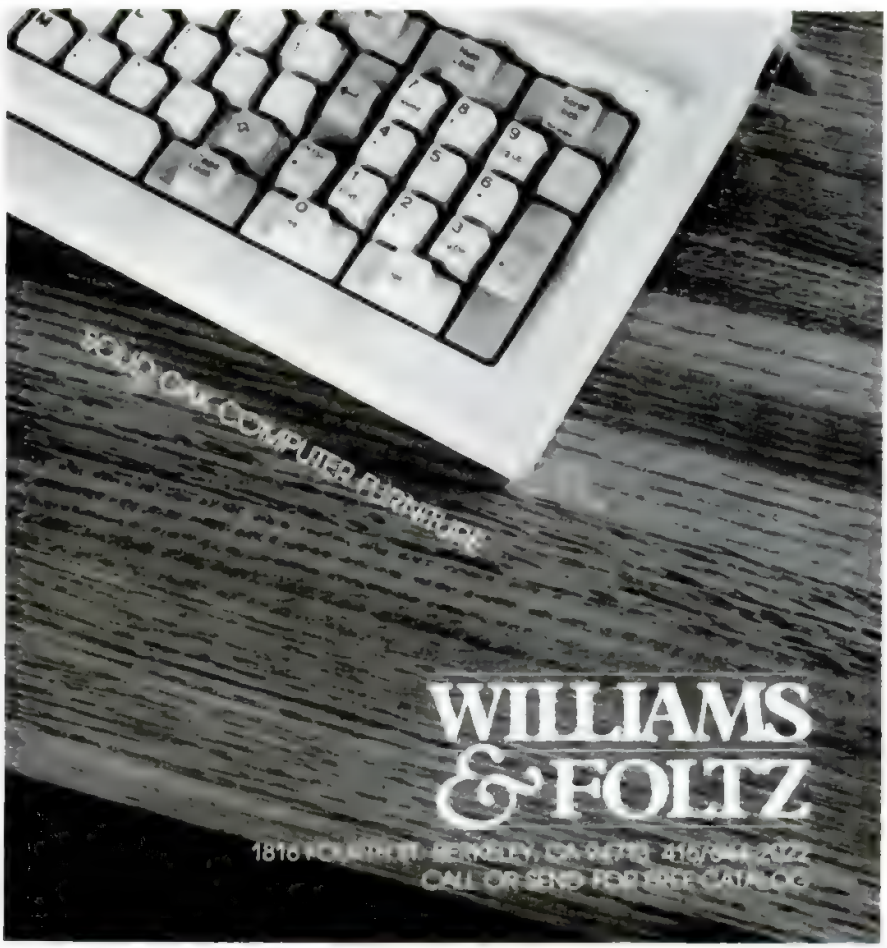
THE ORIGINAL authorship requirement has been satisfied by such seemingly unoriginal items as lamp posts and data bases.

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I mentioned earlier that the copyright law is less than perfect when it comes to protecting software; however, it does a better job of protecting manuals and other literature associated with your program. If someone steals your program, the pirate is likely to steal your manual. It is in your interest to place the proper notice on your written materials and file them with the Copyright Office. Everything already mentioned in terms of notice applies to your written materials as well.

There is little practical information available to the public on how to copyright software. One book you may want to consult is *Legal Care For Your Software* (Addison-Wesley, Reading, Massachusetts, 1982). If you need further information about work for hire agreements, the ramifications of incorrect notices, or license agreements, you may wish to see a lawyer who specializes in computer law. **/PC**

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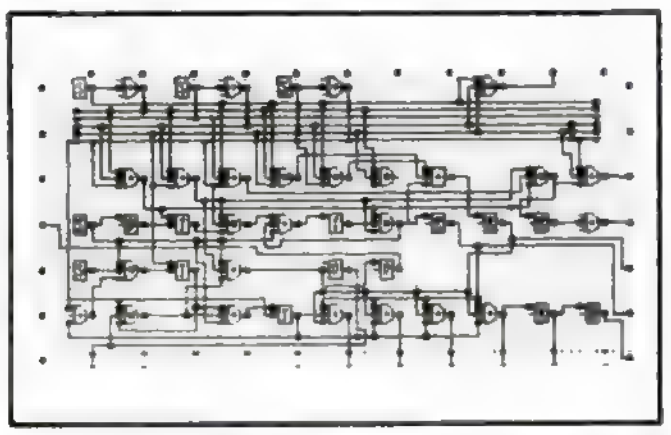
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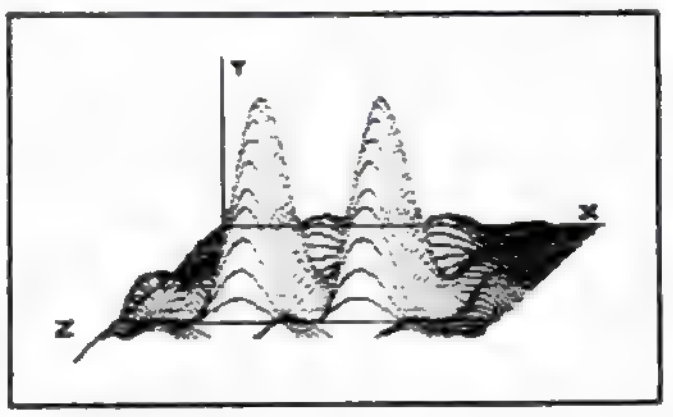
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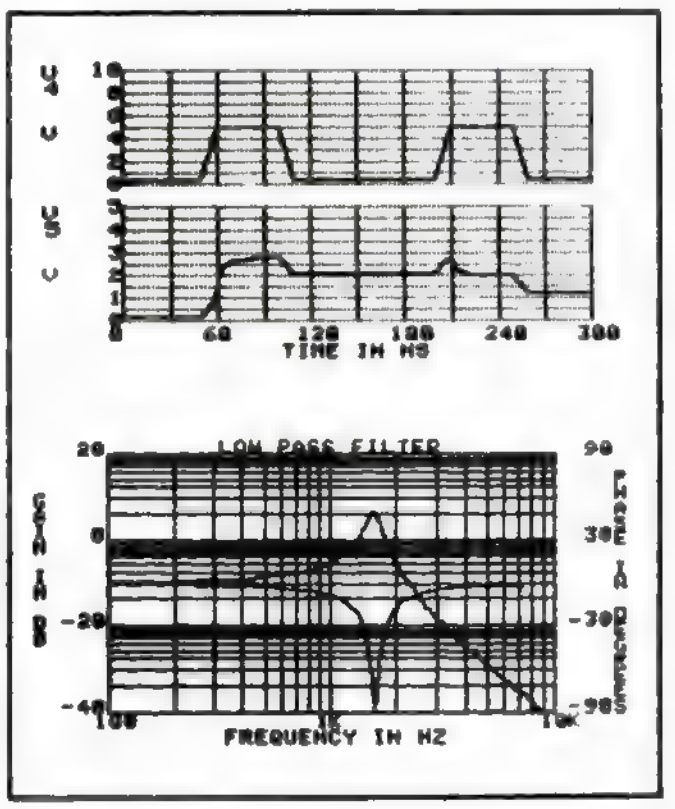


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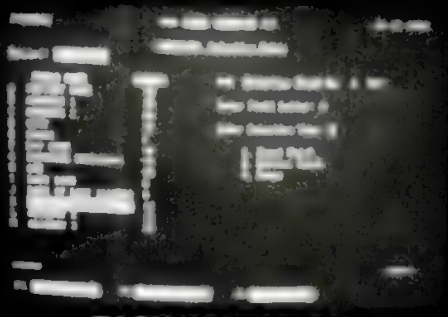
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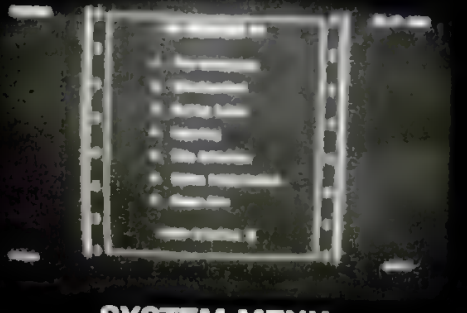
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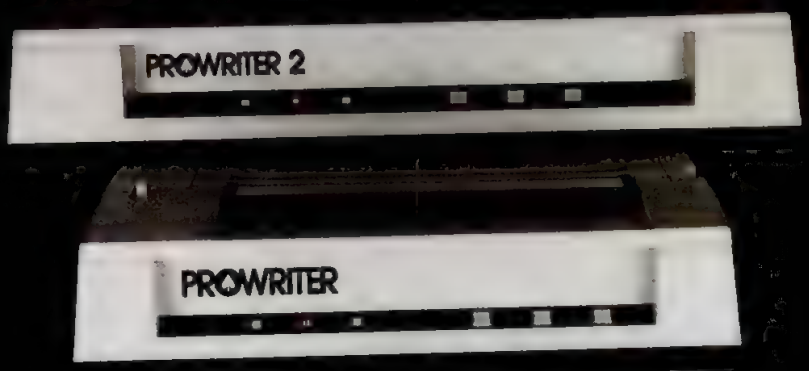
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Humanizing Technology and Computerizing People

Computer Choices: Beware of Conspicuous Computing
H. Dominic Covvey and Neil Harding McAlister
(Addison-Wesley Publishing Company, Inc., Reading, Massachusetts, 1982)
225 pages; $8.95

Amidst the explosive computer technology of the 80s, consumers have been known to make overzealous purchases that may further their social images but undoubtedly don't suit real needs. Computer Choices is written with the conspicuous computer consumer in mind. It aims to clear the air of the flashy jargon and professional sales hype that has flooded the computer market. In this chapter on Human Engineering authors Covvey and McAlister tactfully malign the gap between man and machine.

Human beings and digital computers are basically incompatible. There are vast differences in the ways in which people deal with information and the methods by which computers can input it, manipulate it, and output it. These differences will have an important impact on the ease and success with which any given appliction can be realized.

HUMANIZING TECHNOLOGY

Human output differs substantially from computer input, and vice versa. A frustrating communications barrier therefore exists between user and machine. Computers have only limited capability to be adapted toward a humanlike approach to information input and output. To make matters even more discouraging, the more humanlike the input and output, the greater its cost. In most applications there comes a point beyond which one cannot justify the added expense incurred by further adapting the computer to the user's way of doing business. Even in those rare cases in which money is no object, absolute technological limitations are eventually reached. No amount of money can yet buy a computer system that will listen to ordinary, everyday speech and that will then formulate its own programs on the basis of information that it learns in a conversation.

Human Engineering

Fortunately, with a little thought and planning it is possible for a systems developer to make the best of current technological constraints of computer systems. The systems developer can design a system so that the average user finds it fairly easy to use, in spite of the inherent awkwardness of the technology. This sort of design is called *human engineering*.

Human engineering is the rather fuzzy area that deals with the design of mechanized devices for efficient use by human beings. As such, it is really an expression of the system developer's consideration for the end-users of the system—those with whom the buck finally stops. This consideration is expressed particularly in software, in which the developers will remember that many of the people who will ultimately use their programs will not be as familiar with the programs as they themselves are. Human engineering strives to calm the user's anxiety and to dispel confusion. Software writers who strive to human engineer their products use programs almost as an extension of their own personalities in order to guide the user step by step through the execution of what may be to the user a confusing and complex process.

The personality of its programmer is quite evident in the "character" of a program. The instructions and clarifications that are output by a program should ideally reflect a polite and helpful attitude. Unfortunately, it is not uncommon for users to be confronted with computer instructions that are cryptic, ambiguous, unnecessarily "computeresque," or even downright condescending. The users of computing systems have a right to expect better treatment from the programmers whom they hire to assist them with automation.

Most users care nothing for the arcane intricacies of computer science. They care only about the quality of the service that the computer system provides for them, and this is a reasonable expectation on their part. They have spent their money for a working product, not for lessons in the school of computing hard knocks.

The demands of human engineering are evident in the interface between the computer and its end-users (the input and output processes) and in special user requirements such as the security of data

Illustration: Mark Ericksen

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and system reliability. Each of these areas will be examined now more fully.

The Input Process

Inputting data to a computer system is often one of the more tedious, error-prone and time-consuming aspects of a user's interaction with a computer system. Human engineering of the person/computer input interface requires consideration of both hardware and software features of the system.

There already exists in the marketplace a wide variety of input devices. With this equipment, end-users deal with a computer system in a "hands-on" mode: As such, the convenience of use and suitability to the user's purposes will largely determine the acceptability of a computer system in the user's eyes. Input devices should therefore be chosen with due regard to their functional features. They should not simply be selected by default because one is familiar with them.

The most familiar sort of input device is some variation on an ordinary typewriter keyboard. For certain kinds of data entry such as the input of textual information, a typewriterlike keyboard is often the only acceptable choice. It will therefore be a fact of life in most computing environments that data entry personnel will have to know how to type—at least in a reasonable "hunt-and-peck" mode.

THE USER should send the developer back to the drawing board to come up with output that respects the needs of humans.

In some computing situations, however, the demand that people utilizing input devices have typing skills may severely limit the usability of a system by personnel who do not have clerical training. In an effort to reduce problems of this sort, special keyboard arrangements for nontypists have been developed. For instance, it is possible to buy a keyboard on which all of the letters are arranged in alphabetical order. Whether and where these kinds of keyboards are used depend on the human environment in which they must be employed.

In many circumstances, there are better input devices than keyboards. Many of these are inexpensive, and they should be used whenever they are required. Why ask nontypists to answer multiple-choice questions from a typewriterlike keyboard when they could more easily point with a light pen or even with their fingers at selections on the screen of a video terminal? Such input devices are inexpensive and readily available.

When numerical data must be entered as input, there are several input devices that can reduce the drudgery. A variety of optical mark recognition forms are well suited to direct recording of numbers and of responses to multiple-choice questions on a medium that is directly readable by the computer. This technique permits those who have no typing skills to record data on computer-processable media, thereby eliminating a time-consuming and error-susceptible transcription step by a data entry clerk.

When inputting data from graphs or other continuous curves, it is not necessary to make frequent measurements along the curve in order to determine discrete X and Y coordinates and to then type these numbers into a computer. Instead, a cursor connected directly to the computer can be traced over the length of the curve: Coordinates are determined by the computer itself and data is collected automatically, and thus a great deal of time and effort is saved. Alternatively, the actual signal itself can be digitized either directly or from a tape recording using an analog-to-digital converter.

When human engineering plays an appropriate role in the development of the computer system, the developer will be aware of the spectrum of devices available on the market and will select those devices that will serve the needs and skills of the end users of the system.

In an analogous fashion, programming techniques that direct the input process should also reflect the needs and sophistication of system users. In an input procedure, much potential confusion can be prevented if a computer is programmed to

request individual data items interactively. It can specify in plain language the data that it is expecting, one item at a time. This technique is called prompting.

Human engineering also means that the system developer respects the varying levels of familiarity and expertise among different possible users of the system. For example, although prompting may be an essential aid to one user, it may be a repetitious, boring, and unacceptably time-consuming irritation to a more sophisticated user who has been using a program for some time and who knows what input the computer wants. Sometimes the user should have the option of selecting or suppressing prompting instructions.

Another aspect of programming flexibility should also be considered. Sometimes a computer program that guides the user through a rigid step-by-step sequence of operations may impose unreasonable constraints on the user. For example, when the computer demands that a user provide a series of answers to questions during an input sequence, it frequently is programmed to expect perfect responses to questions. In this situation, the user is given no opportunity to go backwards and to revise portions of the input if they have been entered incorrectly. The user who has made a mistake may therefore be forced to delete the entire record that has just been entered and to enter it again—this time, perfectly. Thus the first effort has been wasted and must be duplicated—perhaps because of one small mistake. This type of rigidity should obviously be avoided. Input programs should also check for obvious mistakes such as values out of range, letters entered where numbers are expected, and items too long or too short in terms of the number of characters. Thoughtful consideration of the human engineering issue involved would motivate a programmer to design software that did not require perfection of the people using a program.

When printed forms are used for data collection, these forms should be designed so that data can be recorded on them easily. They should also be organized in such a way that the keypunchers who read this information and enter it into a computer system can do so conveniently. The data should be recorded on these forms in the same order that the computer requires it as input so that the keypunchers can perform their jobs efficiently, quickly, and without missing anything. These guidelines are simply common sense.

On a more complex level, it is also advisable that the developer require the computer to perform tedious or error-prone tasks whenever possible, in order to unburden data entry personnel. Sometimes it is necessary to encode information before the computer can classify or process it. When these codes are numerous or not readily apparent (as when an arbitrary numeric coding scheme is used), people tend to have a great deal of difficulty. They become frustrated and they make mistakes, because a simple slip of the finger on the input keyboard can misencode something. It is far better if the computer itself performs any encoding, if possible; thus people can input data in a humanly understandable way or at least (by using mnemonics) in a way that will make errors detectable.

COMPUTER systems are only machines, and they will fail sooner or later.

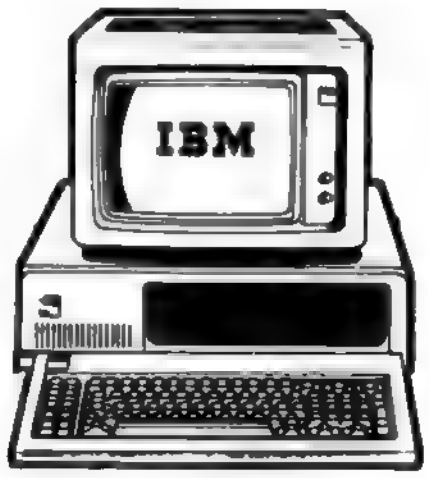
The Output Process

Computer output should also reflect consideration for the people who will have to read it. Again, human engineering both of hardware and of software is important.

The physical output medium that is used is one obvious consideration. There is no reason to produce hard copy unless hard copy is necessary. Making printed output (as contrasted to video screen output) is generally slower, is definitely noisier, and requires a continuing investment in expendable paper. Economics is not the only factor at stake. When confidential information is recorded on paper, that paper has to be guarded or disposed of carefully, whereas images that have faded from a video screen tell no tales.

Other features of output are equally important. Speed, color, and quietness are considerations of human engineering that

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must be treated separately in any application. Nor should it be assumed that the printed word is always the best choice. Pictorial representations are often preferable to lists of numbers. In remote sensing applications, for example, multicolor images on video screens are used to strikingly demonstrate different flora or geographical features. For soft-copy (CRT display) output, the required technology is readily available and presently in use. For hardcopy output, however, we run up against the current technological limits: High-quality, large, multiple-color paper output for such images is presently expensive. The best practical hardcopy output for these images is a color photographic technique. Human engineering might ask for something better, but that "something" may not yet exist at a price we can easily afford.

The quality of print (i.e., solid-face type versus dot-matrix) is also a human engineering consideration. For instance, when computer-produced documents are being used principally for internal archival purposes, the relatively low quality of dot-matrix print might be acceptable. On the other hand, when computer-generated documents are to be sent to customers or colleagues in other centers, one would probably wish to use letter-quality print. The developer should consider this point. The old-fashioned and barely legible upper-case-only typeface produced by many line printers is fast becoming obsolete with more modern printing developments.

HUMAN engineering of computer systems is a goal to which every developer should aspire.

Serious consideration to more legible alternatives should be given as a routine aspect of human engineering the output of any computer system.

Not only hardware but also software should be designed in such a way that output is legible; that important or abnormal values are in some way highlighted; and that the overall result is pleasing and—yes—artistic. For example, there are still a few antediluvian systems in existence that would print the number 3 as 003. The information content of a one-digit integer is obscured by meaningless leading zeroes and a useless decimal point. The usual reasons for such output are lazy programming, or software that is simply old and primitive compared to that which is marketed today. If a developer presents this kind of shoddy output to a user, the user should send the developer back to the drawing board with instructions to come up with output that respects the needs of humans—not with artificial output that reflects computer constraints.

Human-engineered output (or the lack of it) is also manifested in the manner in which programs handle errors during execution. Many operating systems provide a "HELP" facility for both users and programmers. Whenever the computer desires to report an error condition, the user can ask for a more detailed explanation of what has happened and what is required of him or her. This kind of human engineering makes a great deal more sense than computer systems that report only a cryptic error code and that then expect the user to go away and to look up its hidden meaning in some obscure reference manual.

Privacy and Security

The security of sensitive data entrusted to a computer system is an important aspect of the human engineering of computer systems. The systems developer has a responsibility to realize the potential harm that may result if some of the data collected on the system should become widely known or if it should be irretrievably destroyed.

Reliability

Another important goal of human engineering is to design systems with minimum potential for frustrating their users. Bizarre or awkward input procedures and poorly designed output can certainly be quite frustrating. Nevertheless, users will forgive a system that puts them to a great deal of inconvenience as long as that system is reliable. System reliability is taken for granted: Users rightly insist that if they must make the effort to adapt themselves to a computer system, the system must be available when they need it. No other feature of human engineering elicits so little praise or so much condemnation as the reliability of computer systems.

Unreliable computer systems can waste a great deal of users' time. Consider the case of an interactive time-sharing system that "crashes," destroying several hours' work for each of a dozen or more users. If failures of such a widely destructive nature occur frequently, users may get the impression that they would be better off using old manual methods. The system that has been thoughtfully designed will provide *fail-soft* routines that salvage users' work and save it at the time of system failure, so that when the system is repaired the users can be brought back on-line with little or no loss of their data.

COMPUTER output should reflect consideration for the people who will have to read it.

The more an organization comes to rely on automation, the less it can afford computer *downtime*. It is costly to leave clerical personnel sitting idly because of a computer failure. While a computer is out of service, large backlogs of work may accumulate—so large that extra help at overtime rates may be needed to catch up.

In medical environments, for example, the results of system failure could be much more serious than financial loss. Monitoring systems connected to critically ill patients must never be out of operation. Computer-driven laboratory reporting systems are relied on for timely, vital data. These systems dare not fail for more than a few minutes at the most. Short of total hardware redundancy, there is no way to guarantee that a system will have zero downtime. In absolutely critical applications such as monitoring systems, this expensive reality may have to be faced and financed.

In applications such as departmental productivity reporting, a well-rehearsed manual backup procedure may suffice to tide you over a system failure. The neces-

sity of maintaining adequate backup methods in critical applications is a consideration of human engineering that unfortunately receives less attention than it deserves. Some commercial computer systems are marketed without regard to backup of any kind. Their unexpected failures have on occasion thrown a business into complete disarray.

Computer systems are only machines, and therefore they *will* fail sooner or later. The developer who does not think of the consequences of failure fails to serve all of the requirements of the clients.

COMPUTERIZING PEOPLE

Although it is critical to design computer systems with consideration for people's requirements, it is equally important to make the best use of the human resources in an organization—not primarily to serve the computer system, but to permit people to interact with the computer as comfortably as possible.

Computers are often a highly disruptive influence. Those who use them firsthand will be forced to modify how they used to do their daily work manually. Such disruption will necessitate a period of user training, during which productivity will be low and levels of frustration high. The thoughtful system developer will derive useful conclusions from this situation.

First, wherever possible, the developer will bring the most "programmable" staff into the closest interaction with the computer. It goes without saying that it will be easier to schedule a large amount of the clerks' time for user training than it will be to get a captive audience of high level management for the same length of time.

But the developer should strive to soften or even to negate user resentment by demonstrating that the computer returns a benefit to all users that is greater than the sacrifice they must make to use it. A secretary will probably learn to appreciate a system that helps produce the repetitious numerical data of a financial report in half the time it previously took to type the data on an ordinary typewriter. Note that even a large benefit to a third party is unlikely to win the devotion of the individual who is roused from a comfortable routine to learn new, automated techniques. Each individual user must be convinced that the computer system helps him or her personally. "Payback" is the catchword here. If the user perceives payback, the system's probability of success is improved.

BEASTS OF BURDEN

In human interactions, the sort of person who possibly irritates us the most is the petty functionary who is unfriendly, not very intelligent, and officiously insistent on scrutinizing every last inch of bureaucratic red tape at the expense of getting the job done.

In many ways, computer systems are patterned after this kind of exasperating individual. Machines are impersonal and unfriendly. They are dumb. They dogmatically enforce whatever foolish procedures they have been programmed to support. They are nearly incapable of differentiating important information from the mass of trivial data.

Worst of all, computers have become a sort of "intellectual beast of burden" that some human masters falsely assume can

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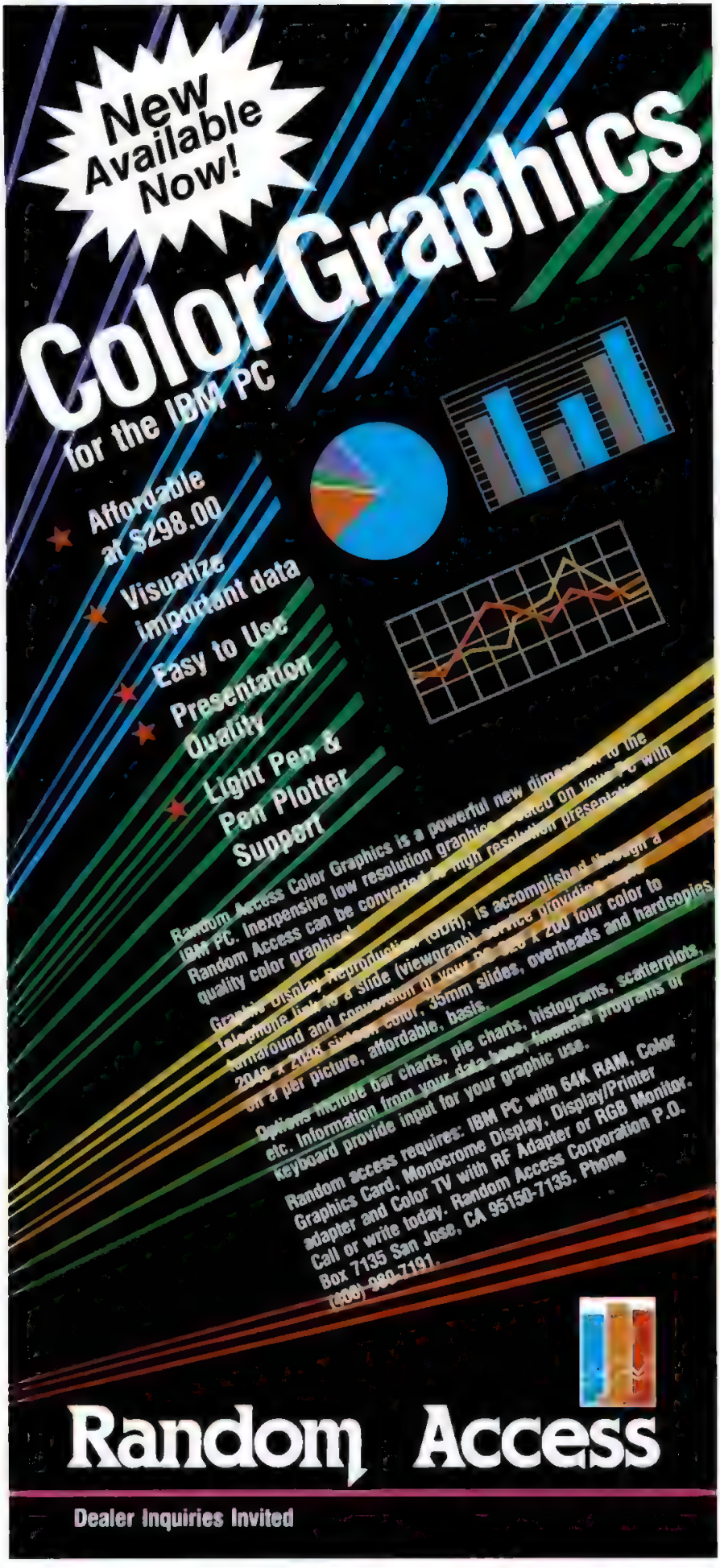
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relieve them of their responsibility to think. Periodically, there are celebrated cases in which checks for huge sums of money are erroneously paid out without

SOFTWARE should be designed so that output is legible.

anyone being aware of the problem before the event. Similarly, we know of a wretched miscreant who received several nasty notices and finally a letter from a collection agency because he would not pay a bill of $0.00! When ultimately he was threatened with legal action, he solved the problem by mailing in a check for $0.00.

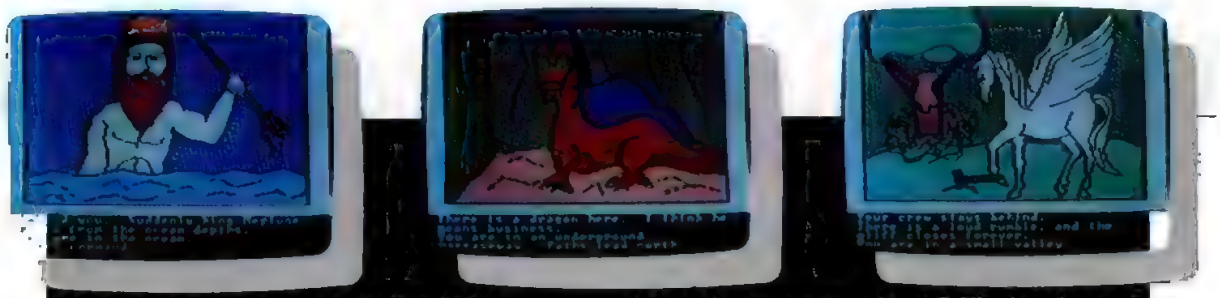
If computers are "intellectual beasts of burden," they deserve the same respect as camels, which—as the joke has it—are horses designed by a committee. These computer beasts are clumsy, ill-tempered, and difficult to get work out of. However, when handled skillfully, they will perform essential services efficiently.

For the foreseeable future, it will continue to be necessary for humans to get around the built-in limitations of hardware and software technology as best they can. The time may come when anyone will be able to use a computer simply by discussing a problem with it. However, until science fiction becomes reality, we will have to adapt our normal way of doing business to the peevish whims of computers. Human users will continue to be forced to express themselves in ways that computers can understand. Similarly, for a long time humans will have to tolerate the sorts of output that computers are capable of providing.

For the present, the best that the users of a computer system can demand is that their systems will be intelligently human-engineered to the furthest practical extent that technology and budget allow. Before accepting any computing system, users must defend their own interests by asking several critical questions: Am I getting something I can use without having to learn a whole new set of skills? Is this computer system really a human-engineered product that I can use easily? Is it the product that I truly need? How good a product

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is it?

Much can be learned about the role of human engineering of technically complex consumer products by considering automobiles. Although a car is complicated and has thousands of parts, its "user interface"—that is, the way in which a driver interacts with it—is simple enough

THE MORE humanlike the input and output, the greater the cost.

that any adult (well, almost any) can operate it properly. There are many kinds of motor vehicles, but driving one is similar to driving any other, whether you get behind the wheel of a taxi, a compact, or a limousine. Over the years, there have been many technical improvements in car design: engines have become more powerful; the center of gravity has become lower; tires have grown wider; structural safety features have improved. However, although drivers have benefited from all these improvements, they have been insulated from any disruption of customary driving skills and habits. The environment of the driver's seat has remained relatively unchanged. When one compares cars to many other kinds of machines and considers the very low level of preventive maintenance that most cars receive, one concludes that cars are astonishingly reliable. When anything does go wrong with them, parts and servicing are readily available.

In short, the automobile is a human-engineered consumer product that, although complex, is easily operated by its end user, the driver. In the same way, computing systems ought to be human-engineered so that they too are usable products, readily understood and operated by their users. Computer scientists may design and implement a system, but their presence should be no more obvious to the end user than the input of an automotive design engineer should be to the average driver.

In general, computer systems have a long way to go before they can be favorably compared to products like automobiles. The current limitations of hardware and software technology impose real constraints on the extent to which human engineering of computer systems is even possible. When a particular computer application is undertaken, a compromise is always struck between technological feasibility and the ideal system that the user would like to have if money and present-day scientific achievement were unlimited. Throughout the life of a computer application, this compromise may have to be periodically "renegotiated" as budgetary constraints, user needs, or technological advancements throw new factors into the equation.

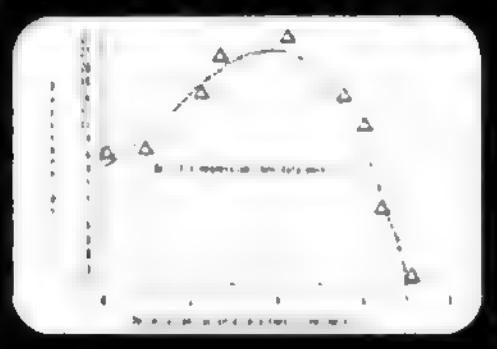
Human engineering, as it applies to computing, is the humane science by which the best possible compromise is struck. Human engineering of computer systems is a goal to which every developer should aspire. It is certainly an issue that all potential users should consider. */PC*

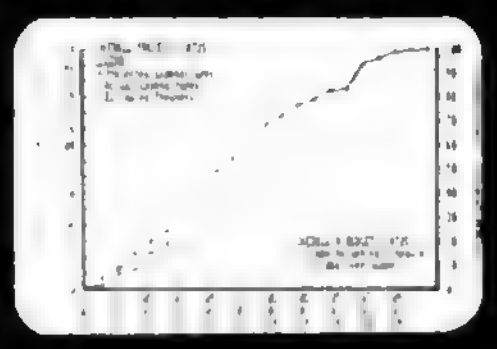
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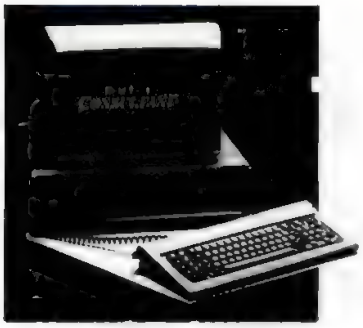
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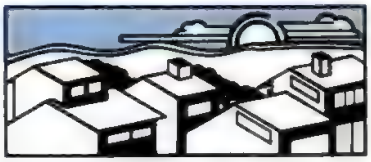
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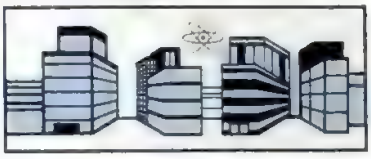


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2) FOR: JAMES REALTY COMPANY
3) PROPERTY ADDRESS CODE: 56 SMITH SANTA CALIF.
4) DATE: MARCH 02 1982

PROPERTY DATA INPUT

5) PRICE OF PROPERTY	=	2,000,000
6) DOWN PAYMENT	=	500,000
7) AMOUNT OF $ 1st LOAN	=	1,000,000
8) INTEREST RATE 1st LOAN	=	10.00
9) NO. YRS. 1st AMORTIZED	=	INTEREST ONLY
10) NO. OF PAYMENTS/YEAR	=	12
11) AMOUNT OF THE 2nd LOAN	=	300,000
12) INTEREST ON 2nd LOAN	=	9.25
13) NO. YRS. 2nd AMORTIZED	=	30.00
14) NO. OF PAYMENTS/YEAR	=	12
15) INITIAL CLOSING COSTS	=	30,000
16) ANNUAL TAX PAYMENTS?	=	24,000
17) ANNUAL INSURANCE COST	=	6,000
18) OTHER OPERATION COSTS	=	40,000
19) % VACANCY FACTOR	=	5.00
20) MONTHLY INCOME	=	19,367
21) % ANNUAL RENT RAISE	=	9.00
22) YOUR INC.TAX BRACKET	=	40
23) DEPRECIABLE AMOUNT	=	1,500,000
24) DEPRECIATION METHOD	=	150
25) DEPRECIABLE YEARS	=	15
26) % SALE COMMISSION	=	5.00
27) % OTHER SALE COSTS	=	1
28) PROJ. RESALE GR= (OR)>		9.73
29) % APPRECIATION/YEAR	=	8.00

30)*** PARTNERSHIP DATA ***

31) ESTMD. PER OF PROFIT	=	15
32) %GENERAL PARTNER TAKE	=	40.00
33) AMT G.P.CASH INVESTED	=	150,000
34) ILIMITED PARTNER TAKE	=	60.00
35) % OTHER TYPE PERS	=	2.00

36)**OTHER MORTGAGES DATA**

37) AMOUNT OF MORTGAGE	=	200,000
38) % INTEREST RATE	=	9.50
39) NO. OF YRS. AMORTIZED	=	25.00
40) NO. OF PAYMENTS/YEAR	=	12

(OUTPUTS)

CURRENT PURCHASE DATA

NO.PYMNT 1st LOAN	=	8333.33
NO.PYMNT 2ND LOAN	=	2468.03
OTHER MONTG. PYMNT.=		1747.39
MONTHLY OPER. EXPS.=		5906.67
MONTHLY COSTS	=	18455.42
CAPITALIZATION RATE=		7.43
NET MULTIPLIER	=	13.46
GROSS MULTIPLIER(X)=		8.66
NET OI/DEBT SERVICE=		0.99
OPER. EXP. RATIO % =		30.69

(OUTPUTS)

	YR/END 1	YR/END 2	YR/END 3	YR/END 4
INCOME DATA				
GROSS INCOME	230,964	251,751	274,408	299,105
-VACANCIES	11,548	12,588	13,720	14,955
-OPERATION COSTS	70,880	77,259	84,213	91,792
=NET OPER'G INCOME	148,536	161,905	176,476	192,359
-1st MORTG. PYMNT.	100,000	100,000	100,000	100,000
-2nD MORTG. PYMNT.	29,616	29,616	29,616	29,616
-OTHER MORTG.PYMNT.	20,969	20,969	20,969	20,969
=ANNUAL CASH FLOW	-2,049	11,319	25,890	41,773
% C.F. RETURN PER YEAR=	-0.30%	+2.14%	+4.89%	+7.88%
****TAX DATA****				
NET OPERATING INCOME=	148,536	161,905	176,476	192,359
-INTEREST EXPENSE	146,982	146,189	145,758	145,285
+INTEREST DISALLOWED	0	0	0	0
-DEPRECIATION	106,667	106,667	106,667	106,667
=TAXABLE INCOME	-104,712	-90,950	-75,948	-59,593
CASH TAX SAVINGS	41,885	36,381	30,360	23,836
YIELD ON TAX SAVINGS	+7.90%	+6.86%	+5.73%	+4.50%

THE FOLLOWING INDICATE RESULTS AFTER SALE.

****SALE DATA****				
SALE PRICE=	2,434,970	2,675,481	2,916,275	3,170,740
-1st LOAN BALANCE	1,000,000	1,000,000	1,000,000	1,000,000
-2nd LOAN BALANCE	298,053	295,917	293,576	291,008
-OTHER MORTG. BALANCES	197,944	195,683	193,198	190,466
=EQUITY	938,373	1,183,881	1,429,502	1,687,266
-SALE COMMISSION	122,729	133,774	145,814	158,937
-SALES COSTS	24,346	26,755	29,163	31,787
-TAX DUE ON CAP.GAINS	61,434	111,728	165,008	221,549
-TAX DUE ON DEPRE.RECAP	0	0	0	0
=SALES PROCEEDS	749,865	911,627	1,089,517	1,284,993
TAXABLE INCOME AT SALE				
CAPITAL GAINS INCOME	383,962	698,286	1,031,298	1,384,682
DEPRE. RECAP.INCOME	0	0	0	0
****PROFITS****				
SALE PROCEEDS	749,865	911,627	1,089,517	1,284,993
-DOWN PAYMENT	500,000	500,000	500,000	500,000
-INITIAL CLOSING COST	30,000	30,000	30,000	30,000
=NET SALE PROFIT	219,865	381,627	559,517	754,993
TOTAL NET GAINS				
NET SALE PROFIT	219,865	381,627	559,517	754,993
+ SYNDICATION FEE	52,980	57,244	83,928	113,249
+OTHER TYPE FEE	4,397	7,633	11,190	15,100
= NET PROFIT RETURN	182,488	316,750	464,399	626,644
GEN.PTR. CASH PROFIT	72,995	126,700	185,760	250,658
LTD.PTR. CASH PROFIT	109,493	190,050	278,640	375,986
** TOTAL NET % GAIN **				
NET PROFIT RETURN	182,488	316,750	464,399	626,644
/(DWN.PYMT+CLOS.COST)	530,000	530,000	530,000	530,000
% NET SALE PROFITS	+34.43%	+59.76%	+87.62%	+118.23%
% TOTAL CASH FLOWS	-0.39%	+1.73%	+4.89%	+14.32%
% TOTAL TAX SAVINGS	+7.90%	+14.76%	+20.49%	+24.99%
= % TOTAL NET RETURNS	+41.94%	+76.27%	+114.75%	+157.74%
/ NO. OF YEARS (CMPD)	1	2	3	4
= % RETURN/YEAR (CMPD)	+41.94%	+30.77%	+29.03%	+28.71%
% GENRL.PTR.GAINS	+68.66%	+86.47%	+123.84%	+167.11%
% GEN.PTR. CASH FLOWS	-0.55%	+2.47%	+9.38%	+20.32%
% GEN.PTR. TAX SAVINGS	+11.17%	+20.87%	+28.97%	+35.33%
= % TOTAL GEN.PTR.RETURN	+99.28%	+107.81%	+162.19%	+222.95%
/ NO. OF YEARS (CMPD)	1	2	3	4
= GEN.PTR. RTN/YR.(CMPD)	+99.28%	+46.16%	+37.89%	+34.06%
%LIMITED PTR.GAINS:	+28.81%	+50.01%	+73.33%	+98.94%
% LTD.PTR.CASH FLOWS:	-0.32%	+1.46%	+5.55%	+12.15%
+ % LTD.PTR.TAX SAVED:	+6.61%	+12.36%	+17.15%	+20.91%
= % TOTAL LTD. RETURN:	+35.10%	+63.83%	+96.03%	+132.01%
/.NO. OF YEARS (CMPD)	1	2	3	4
= LTD.PTR. RTN/YR.(CMPD)	+35.10%	+28.90%	+25.15%	+23.47%

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Santa Barbara CA 93105

SUM OF THE YEARS TAX DEPRECIATION
(C) CONSULTANT SYSTEMS INC.

PRICE = $ 2,000,000
SALVAGE VALUE = $ 400,000
NET DEPRECIABLE = $ 1,600,000
LIFE = 15 YEARS
METHOD = 0 %
STARTING MONTH = 1

YEAR	DEPRECIATION	BALANCE
1	200,000	1,400,000
2	186,667	1,213,333
3	173,333	1,040,000
4	160,000	880,000
5	146,667	733,333
6	133,333	600,000
7	120,000	480,000
8	106,667	373,333
9	93,333	280,000
10	80,000	200,000
11	66,667	133,333
12	53,333	80,000
13	40,000	40,000
14	26,667	13,333
15	13,333	0

DECLINING BALANCE TAX DEPRECIATION
(C) CONSULTANT SYSTEMS INC.

PRICE = $ 2,000,000
SALVAGE VALUE = $ 400,000
NET DEPRECIABLE = $ 1,600,000
LIFE = 15 YEARS
METHOD = 175 %
STARTING MONTH = 1

YEAR	DEPRECIATION	BALANCE
1	186,667	1,413,333
2	164,889	1,248,444
3	145,652	1,102,793
4	128,659	974,133
5	113,649	860,485
6	100,390	760,095
7	88,678	671,417
8	78,352	593,065
9	69,193	523,892
10	61,121	462,771
11	53,990	408,781
12	47,691	361,090
13	42,127	318,963
14	37,212	281,750
15	32,871	248,880

DECLINING BALANCE TAX DEPRECIATION
(C) CONSULTANT SYSTEMS INC.

PRICE = $ 2,000,000
SALVAGE VALUE = $ 400,000
NET DEPRECIABLE = $ 1,600,000
LIFE = 15 YEARS
METHOD = 125 %
STARTING MONTH = 1

YEAR	DEPRECIATION	BALANCE
1	133,333	1,466,667
2	122,222	1,344,444
3	112,037	1,232,407
4	102,701	1,129,707
5	94,142	1,035,564
6	86,297	949,267
7	79,106	870,162
8	72,513	797,648
9	66,471	731,178
10	60,931	670,246
11	55,854	614,392
12	51,199	563,193
13	46,933	516,260
14	43,022	473,238
15	39,437	433,802

STRAIGHT LINE TAX DEPRECIATION
(C) CONSULTANT SYSTEMS INC.

PRICE = $ 2,000,000
SALVAGE VALUE = $ 400,000
NET DEPRECIABLE = $ 1,600,000
LIFE = 15 YEARS
METHOD = 100 %
STARTING MONTH = 1

YEAR	DEPRECIATION	BALANCE
1	106,667	1,493,333
2	106,667	1,386,667
3	106,667	1,280,000
4	106,667	1,173,333
5	106,667	1,066,666
6	106,667	960,000
7	106,667	853,333
8	106,667	746,666
9	106,667	640,000
10	106,667	533,333
11	106,667	426,666
12	106,667	320,000
13	106,667	213,333
14	106,667	106,666
15	106,667	-0

AMORTIZATION SCHEDULE
(C) CONSULTANT SYSTEMS INC.

LOAN AMOUNT = $ 300,000.00
MONTHLY PAYMENT = $ 2,668.03
INTEREST RATE = 9.250%
STARTING YEAR = 82
STARTING MONTH = 1
DAY PAYMENT DUE = 15

DATE	INTEREST	PRINCIPAL	BALANCE
Interest For 81	0.00		
Jan/ 15 / 82	2,312.50	155.53	299,844.47
Feb/ 15 / 82	2,311.30	156.73	299,687.74
Mar/ 15 / 82	2,310.09	157.94	299,529.80
Apr/ 15 / 82	2,308.88	159.15	299,370.65
May/ 15 / 82	2,307.65	160.38	299,210.27
Jun/ 15 / 82	2,306.41	161.62	299,048.65
Jul/ 15 / 82	2,305.17	162.86	298,885.79
Aug/ 15 / 82	2,303.91	164.12	298,721.67
Sep/ 15 / 82	2,302.65	165.38	298,556.29
Oct/ 15 / 82	2,301.37	166.66	298,389.63
Nov/ 15 / 82	2,300.09	167.94	298,221.69
Dec/ 15 / 82	2,298.79	169.24	298,052.45
Interest For 82	27,668.81		
Jan/ 15 / 83	2,297.49	170.54	297,881.91
Feb/ 15 / 83	2,296.17	171.86	297,710.05
Mar/ 15 / 83	2,294.85	173.18	297,536.87
Apr/ 15 / 83	2,293.51	174.52	297,362.33
May/ 15 / 83	2,292.17	175.86	297,186.49
Jun/ 15 / 83	2,290.81	177.22	297,009.27
Jul/ 15 / 83	2,289.45	178.58	296,830.69
Aug/ 15 / 83	2,288.07	179.96	296,650.73
Sep/ 15 / 83	2,286.68	181.35	296,469.38
Oct/ 15 / 83	2,285.28	182.75	296,286.63
Nov/ 15 / 83	2,283.88	184.15	296,102.48
Dec/ 15 / 83	2,282.46	185.57	295,916.91
Interest For 83	27,480.82		
Jan/ 15 / 84	2,281.03	187.00	295,729.91
Feb/ 15 / 84	2,279.58	188.45	295,541.46
Mar/ 15 / 84	2,278.13	189.90	295,351.56
Apr/ 15 / 84	2,276.67	191.36	295,160.20
May/ 15 / 84	2,275.19	192.84	294,967.36
Jun/ 15 / 84	2,273.71	194.32	294,773.04
Jul/ 15 / 84	2,272.21	195.82	294,577.22
Aug/ 15 / 84	2,270.70	197.33	294,379.89
Sep/ 15 / 84	2,269.18	198.85	294,181.04
Oct/ 15 / 84	2,267.65	200.38	293,980.66
Nov/ 15 / 84	2,266.10	201.93	293,778.73
Dec/ 15 / 84	2,264.54	203.49	293,575.24
Interest For 84	27,274.69		
Jan/ 15 / 85	2,262.98	205.05	293,370.19
Feb/ 15 / 85	2,261.40	206.63	293,163.56
Mar/ 15 / 85	2,259.80	208.23	292,955.33
Apr/ 15 / 85	2,258.20	209.83	292,745.50
May/ 15 / 85	2,256.58	211.45	292,534.05
Jun/ 15 / 85	2,254.95	213.08	292,320.97
Jul/ 15 / 85	2,253.31	214.72	292,106.25
Aug/ 15 / 85	2,251.65	216.38	291,889.87
Sep/ 15 / 85	2,249.98	218.05	291,671.82
Oct/ 15 / 85	2,248.30	219.73	291,452.09
Nov/ 15 / 85	2,246.61	221.42	291,230.67
Dec/ 15 / 85	2,244.90	223.13	291,007.54
Interest For 85	27,048.66		

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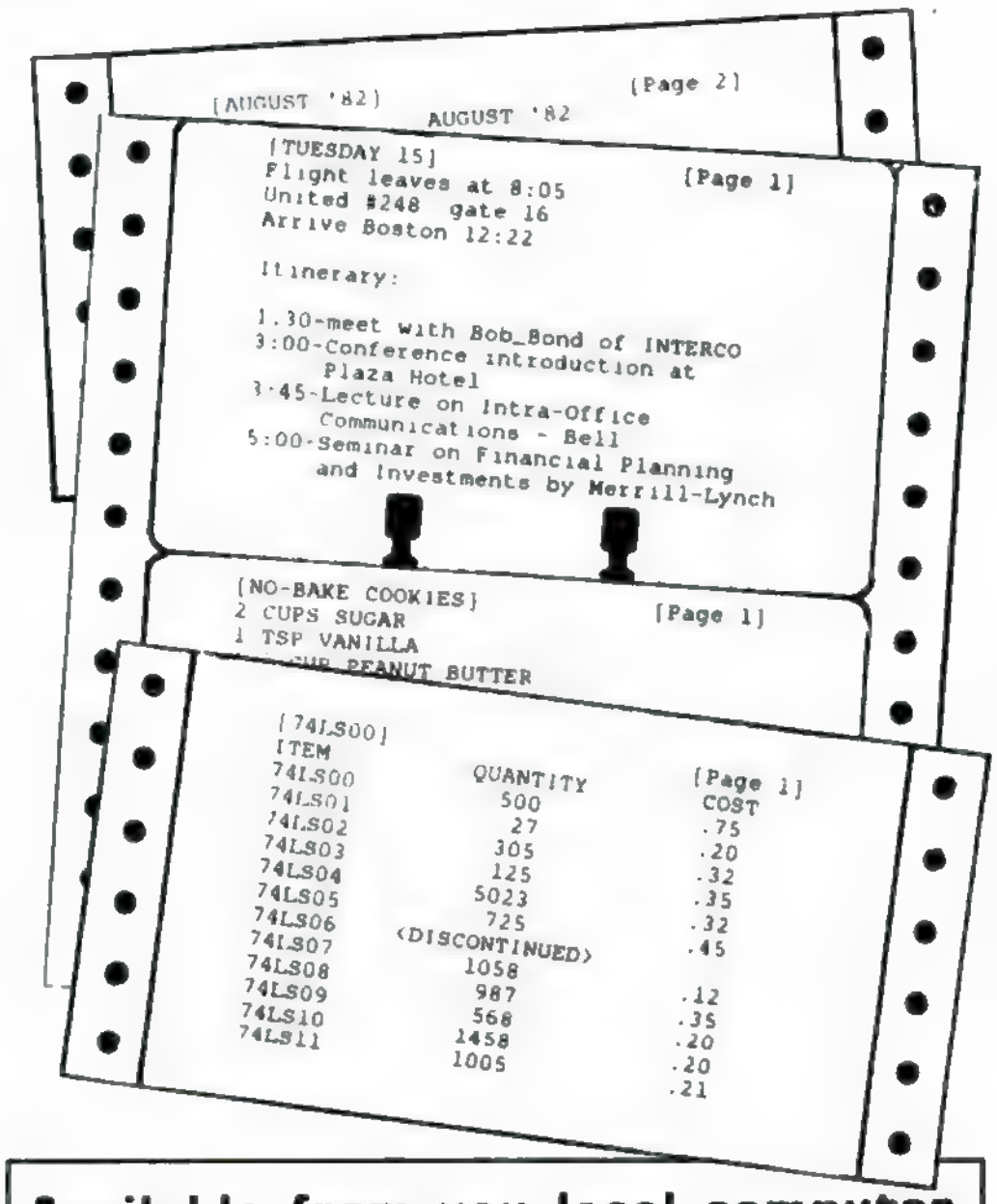
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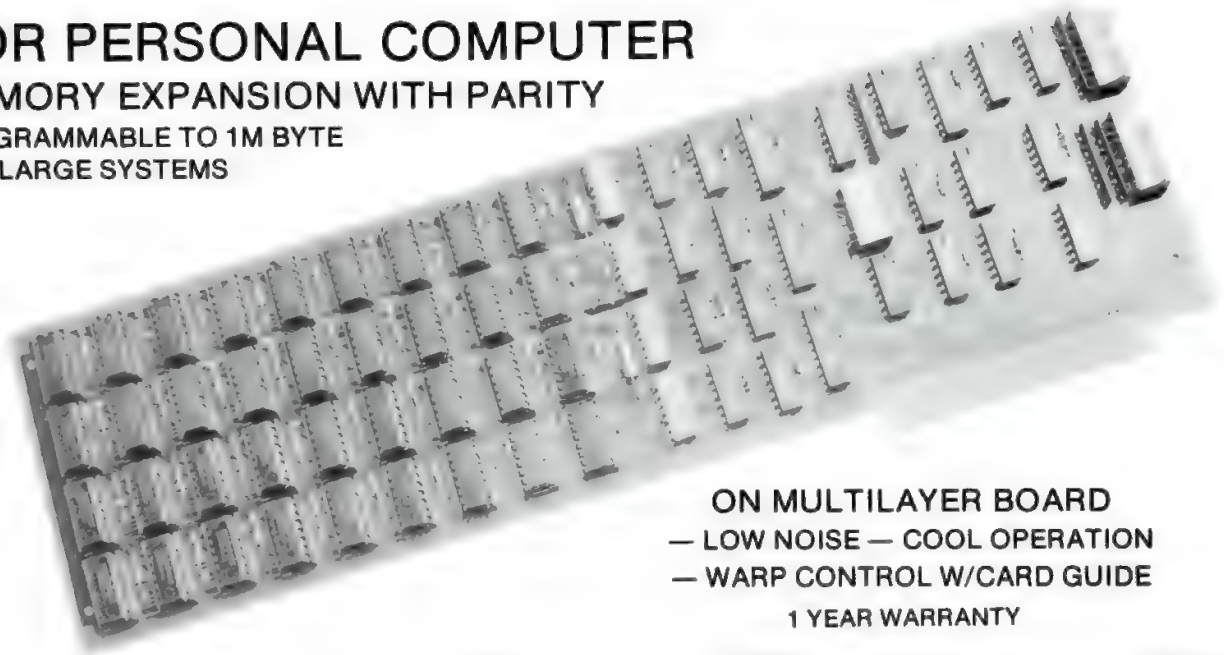
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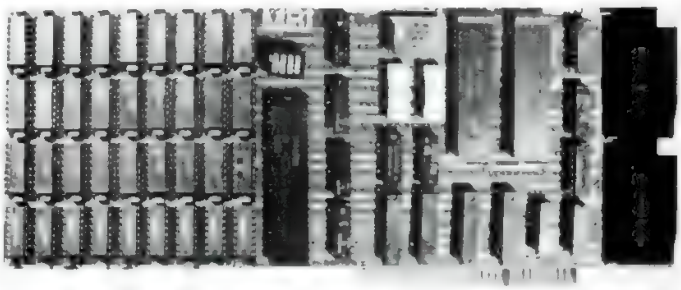
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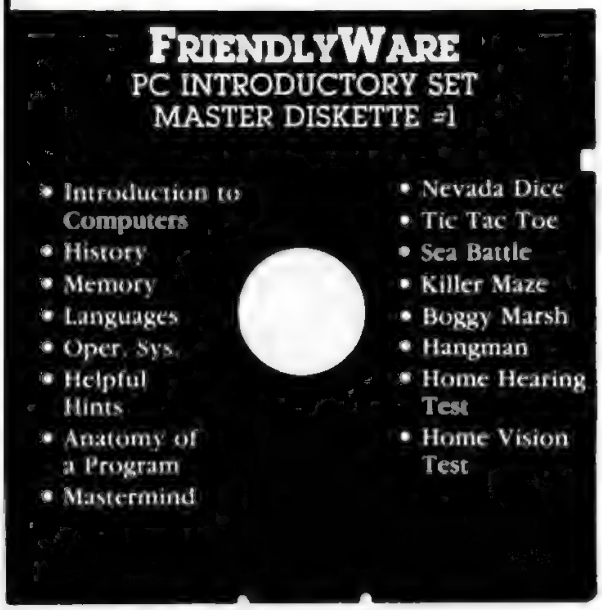
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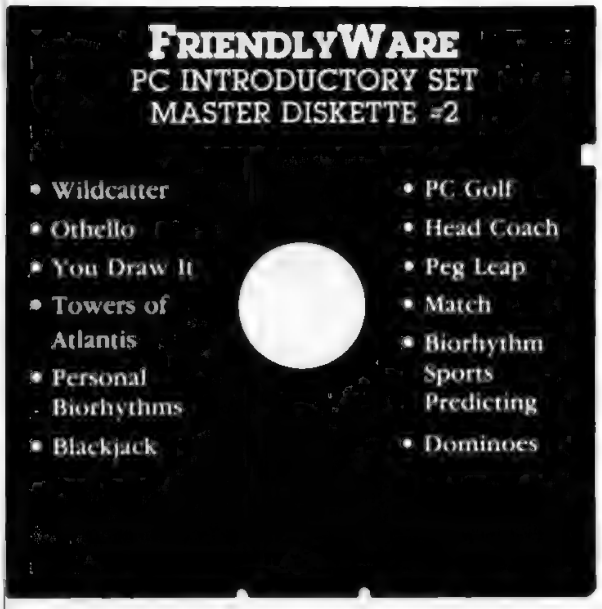
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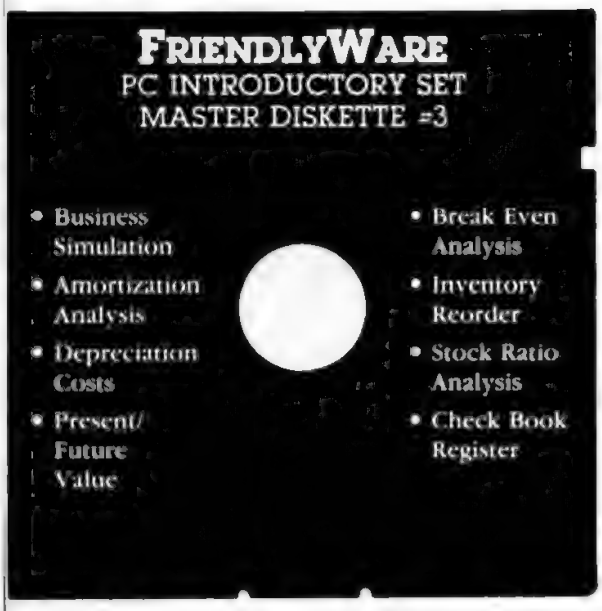
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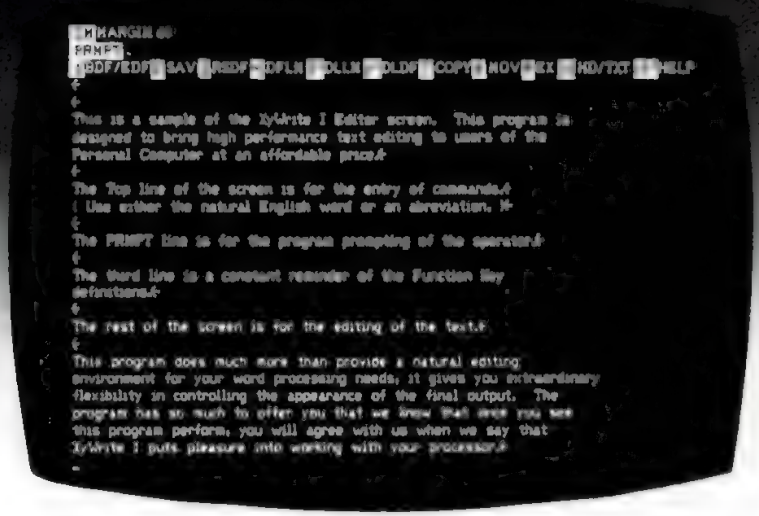
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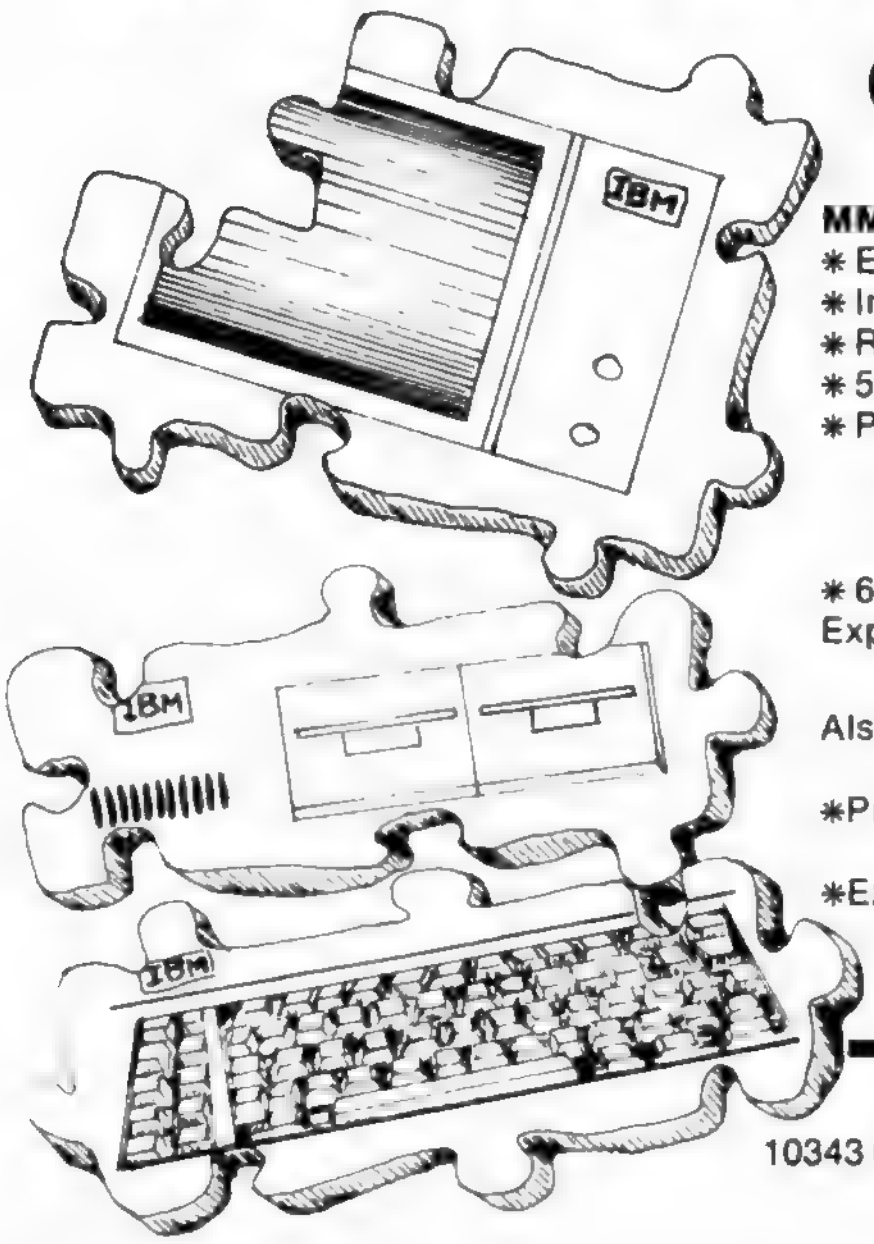
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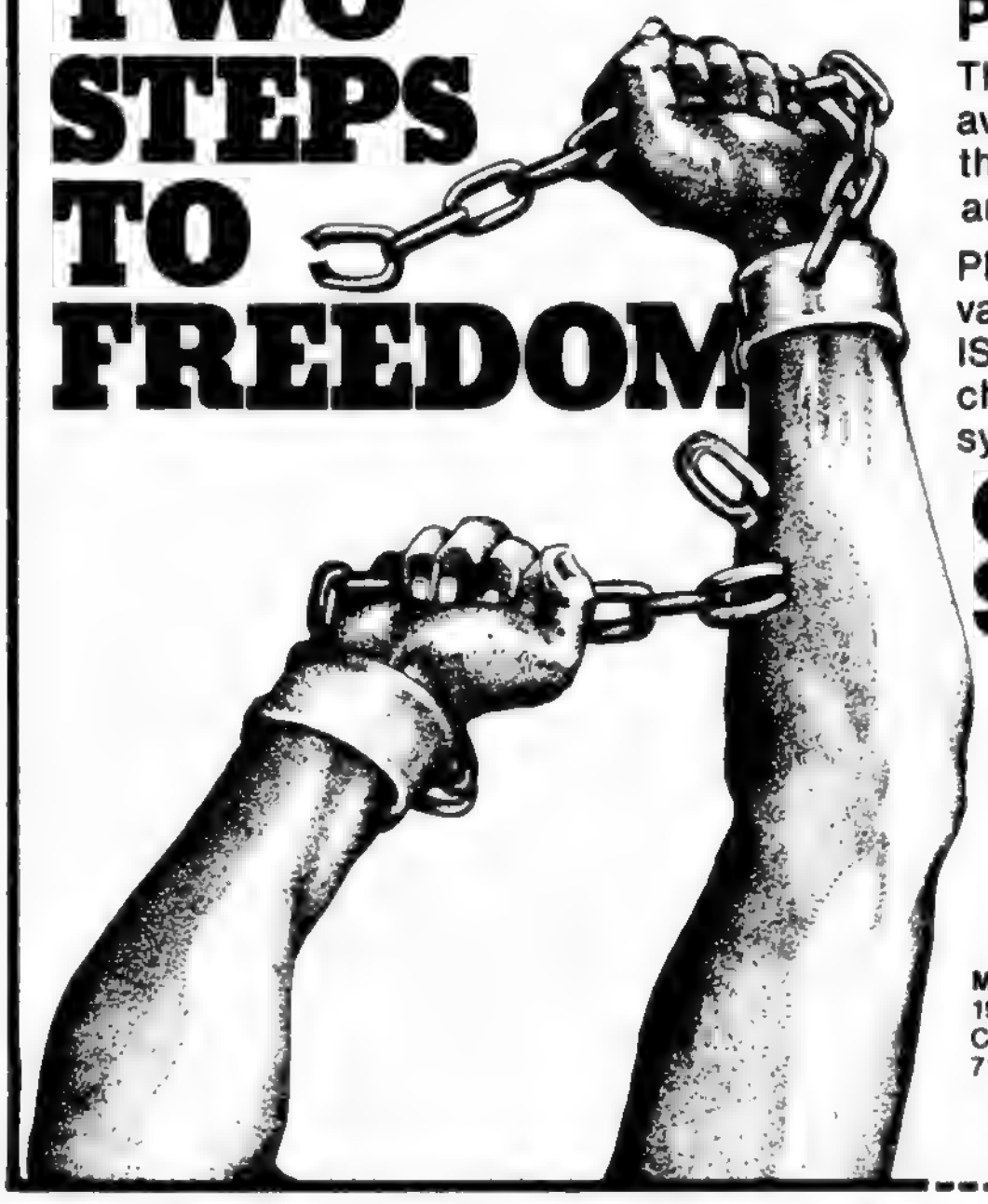
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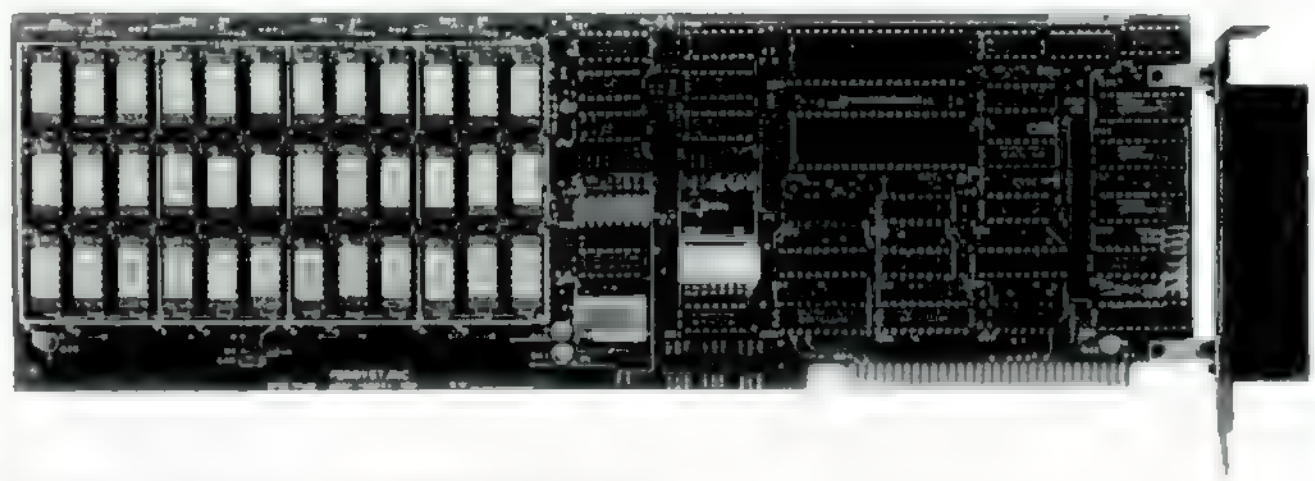
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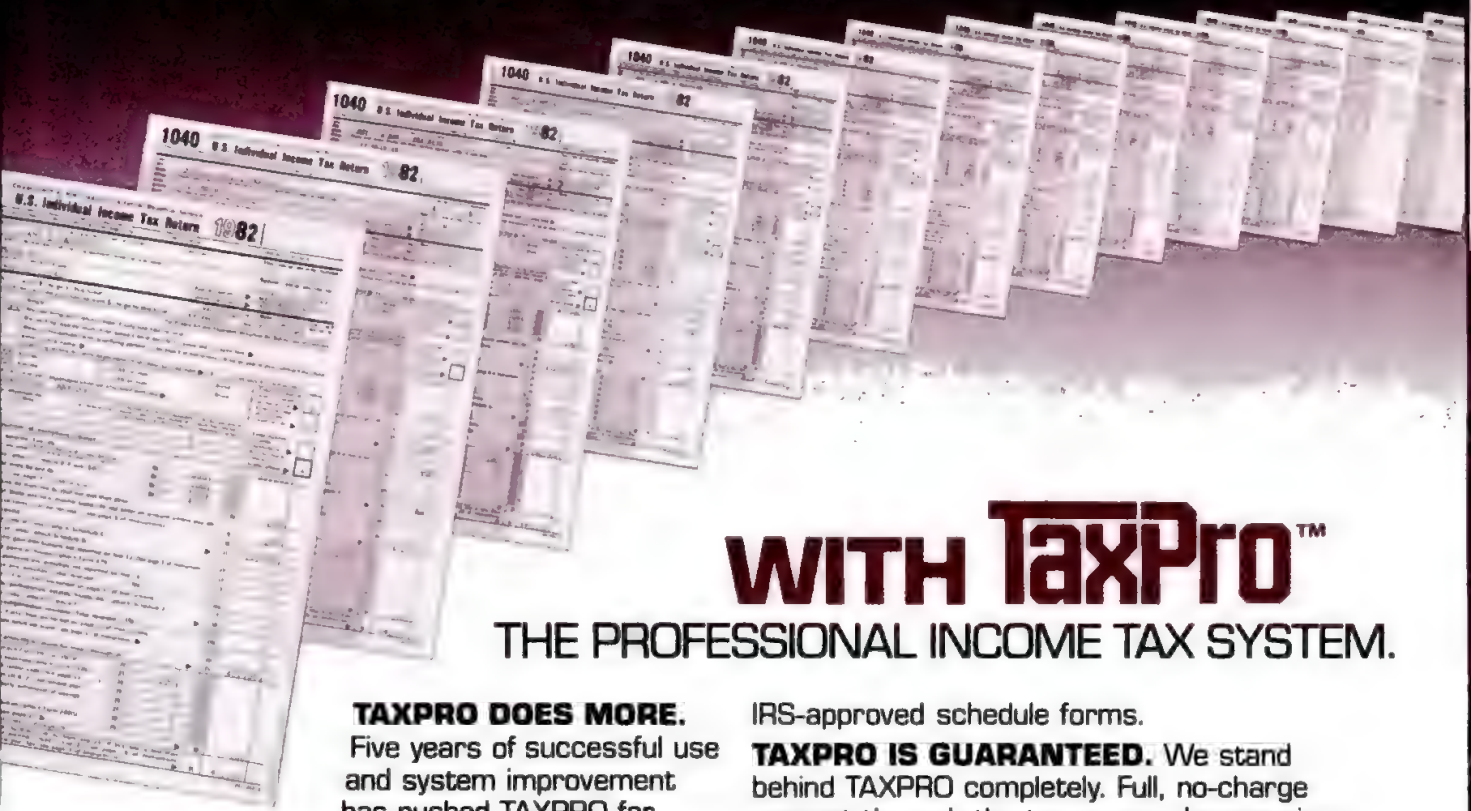
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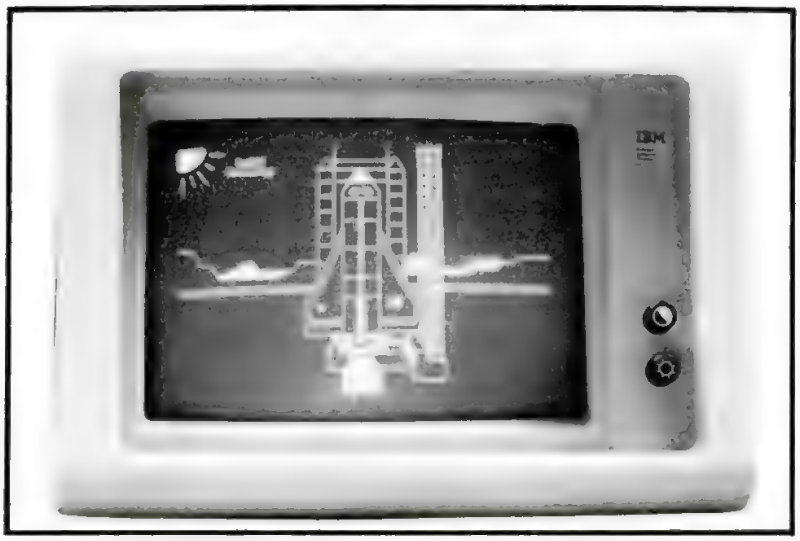
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Figure 1: Build-up of IBM PC to Super Smart Terminal

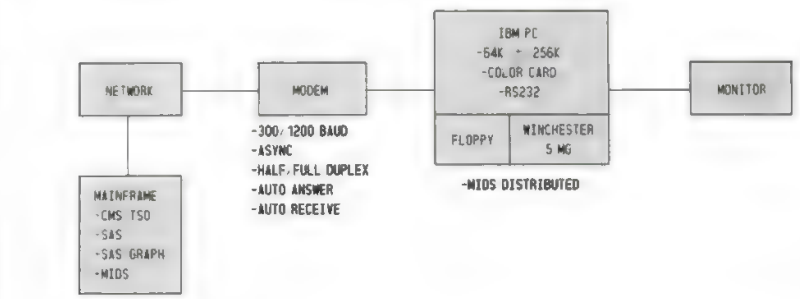
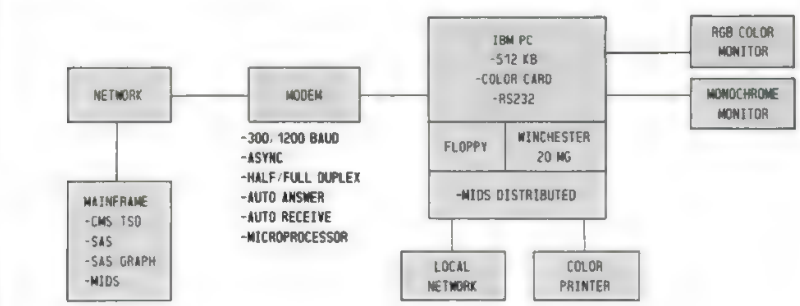


Figure 2: Executive Work Station



Marketing Information Data Systems (MIDS) is a consulting firm that sells a data base designed to assist and simplify executive decision making. What began as an aid to decision making rapidly became unmanageable when an 18-variable data base used to align sales territories for a large appliance manufacturer evolved into a 50-variable data base. The major benefits of the MIDS system were disappearing. Mainframe technology couldn't solve the problems of turnaround, data access, quick analysis, and instant display. The time and money involved in mainframe usage, storage, and telephone line charges made the system even more impractical.

The introduction of the IBM Personal Computer solved many of these problems and ended the search for a terminal with sufficient storage to handle eight to ten data base variables simultaneously, sufficient internal memory to organize variables in a meaningful way, power to invert a medium-size matrix, and enough internal memory to hold this information. Today the MIDS data base contains over 500 variables—over 1.5 million data points.

MIDS purchased an early version of the IBM PC with a monochrome monitor, two disk drives, and 128K of internal memory. The PC immediately became the favorite terminal in the shop and was used for off-line data input, formatting, data manipulation, and rapid loading into the IBM host computer for additional manipulation. An acquired taste for color was satisfied by a combination of the IBM color/graphics adapter and the availability of several excellent RGB color monitors.

WHAT STARTED out as a quest for a smart terminal led to the discovery of a powerful tool.

With the PC, MIDS did more and more processing locally instead of going in and out of the mainframe. The firm also enjoyed a dramatic reduction in telephone line charges.

To handle the demands of its system MIDS plans to buy a 20-megabyte Winchester disk. For the normal user, however, one 5-megabyte Winchester should be sufficient. The addition of 256K of internal memory to facilitate data transfer and a PRISM four-color printer by Integral Data Systems completed the executive package.

Many data bases contain an unmanageable number of files. The MIDS system with IBM PC hardware gives the user simple access to large-scale data bases, organizing them in a way that is manageable

for decision making. What started out as a quest for a smart terminal led to the discovery of a powerful tool that interacts with mainframes and does a large percentage of the work on a stand-alone basis. The MIDS system is able to decide what can be done locally and what must be sent to the host computer.

With the components that make up this unit, the long-touted executive work station seems to have arrived. And the software is available today to make it useful.

The MIDS software is written in Pascal and uses PC-DOS or Pascal. The basic system requires an 80-column monitor, 64K, two disk drives (one is a 5-megabyte Winchester), a graphics option for the printer, and an asynchronous communications adapter.

The schematic of the super smart terminal using the IBM PC is shown in Figure 1. Figure 2 is a configuration that will do "almost anything." The spare monochrome terminal can be used as a scratch pad for building displays on the color terminal. */PC*

Purchase price of the MIDS software is $1,500. For information on the MIDS system, contact James C. Becknell, Carl Peters, or Michele Steigleder at MIDS, 6959 Arapaho Rd., Dallas, TX 75248 (214) 934-8888.

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- CPI NEW indexes "old dollars" to their current value.
- CPI OLD indexes current dollars back to any prior year.
- GROWTH computes an annual average growth rate according to the following formula.

$$\left[\frac{X_1}{X_2} + 1\right]^{1/n} - 1$$

Where X_1 = sales in most current year
X_2 = sales in base year
n = number of years in average

- PRINT prints the variable(s) specified by the user. The variable(s) being printed can be classified or sorted according to another variable (sort variable). Unless specified, the print command will print variables in ascending order.
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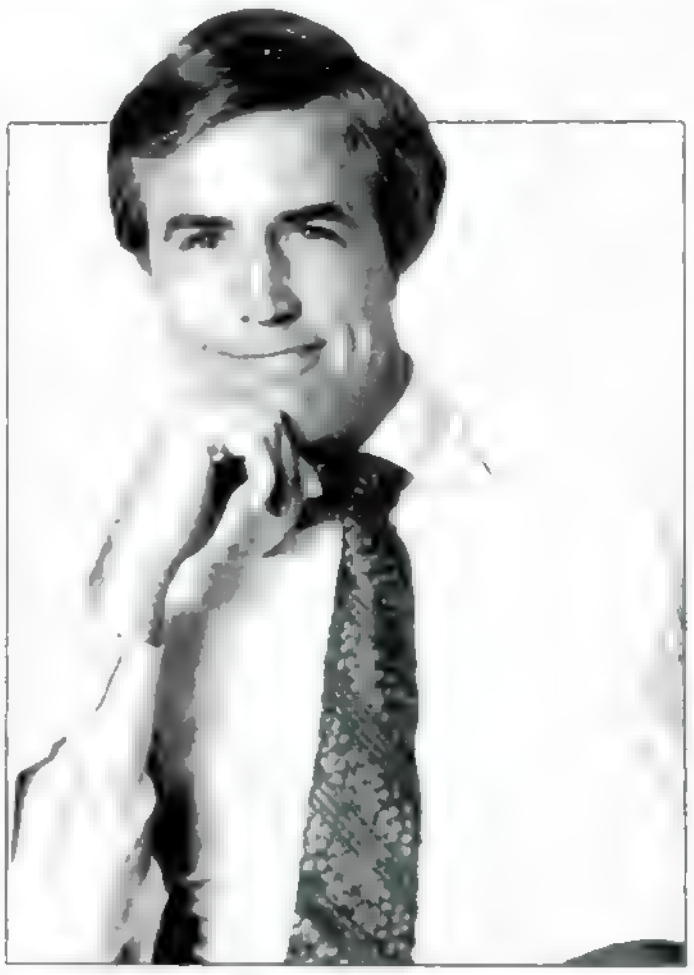
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PC Comes Of Age For Architects

Architect Nelson Johnson has created computer-aided design for the PC.

Many PC owners are people who had no experience with computers until they bought the IBM micro. Nelson Johnson is not one of the neophytes, however; he began building "model" computers as a boy and studied programming and computer operation during his college days.

"I was a ham radio operator as a kid," he recalls, "and I became fascinated by the idea of computers. But there were no computers I could use. It cost about $60 a minute to use a computer then, and I had no access. I built cardboard computers and pretended they were real. I loved the idea of machines that could do complex things. It was like Flash Gordon or *Star Wars* or something."



Nelson Johnson

I HAVE wanted to create aids that make doing architecture easier.

Tapping Computer Power

Since the days of imagining what computers could do, Johnson has been putting them to work in his career as an architect. Except for the cardboard models, most of his college and graduate school courses in computer science were intended to help him solve problems in his design work. When he was studying architecture at Columbia graduate school in the early 1970s, programming meant keypunching and carrying stacks of cards across campus to the basement where students were given access to the university's large computers. Considering the limited computer time available to students, as well as the breakdown rate of computers in those days, a Flash Gordon-style zeal was required to become an experienced programmer. That dedication has paid off, Johnson believes, now that he and other architects can have immediate access to computers at an affordable cost. "In architecture," he points out, "the real computer revolution has been in small computers."

Anticipating that revolution about 2 years ago, Nelson founded the Computer Forum, a special interest group of the American Institute of Architects. The group meets monthly to attend presentations from manufacturers or distributors of computer systems, as well as to exchange ideas and experience in architectural applications. "It's a first for the architectural community to be directly exposed to computer manufacturers and software developers," says Johnson.

Although he put together a small computer several years ago and has worked with computers in architecture firms, Nelson Johnson didn't purchase a microcomputer for his own business until he found one that offered both professional level computing power and excellent graphics capabilities. He discovered the PC's microprocessor, the Intel 8088, before IBM had announced the computer that uses it.

"I got on Intel's mailing list somehow, and one of the things they sent me was an advertisement for the 8088 microprocessor. I took one look at it and said, 'Now I can do graphics.' You can't create high-resolution graphics that are fast with 8-bit technology, but you can with 16 bits. So I started to think about building a 16-bit computer. Then I read that IBM was coming out with the Personal Computer and that it was going to have the 8088 microprocessor—that sold me."

Computer-Aided Design for Micros

Since getting his PC in December 1981, Nelson has put at least 1,000 hours into a program for architects and other designers that lets the user plot images on the screen and can even show these images in three dimensions. The program, *MicroCAD*, is the first implementation of computer-aided design (CAD) for microcomputers, and its ability to display images in perspective is a feature even some minicomputer CAD systems don't offer. This PC program differs in both cost and features from the prohibitively expensive mini-based CAD systems; it does not produce working drawings or drafting for design projects.

What Nelson Johnson has provided is another highly useful dimension of computer-aided design, one architects can afford to buy and use themselves rather than turning over their designs to a specially trained computer operator who then does the drafting on a $30,000 CAD system. "It's another way of doing something," the architect explains. "It gives you another tool. If you're an architect and you have an IBM PC with 64K and a color graphics card, why not get a system that allows you to demonstrate three-dimensional views of objects?"

MicroCAD utilizes the PC's color graphics card, although the program does not use color in creating images. A black

Photograph: Jacqueline Poitier

and white or color monitor that can display graphics characters (not the IBM monochrome monitor, which cannot display graphics) is connected to the color card and is used to show the images. Johnson points out that designers can best use the program if they have both the monochrome and color cards in the PC and two monitors. *MicroCAD* can be configured for either a one- or two-monitor system; if two monitors are available, the menus, instructions, and lists of plotting points are displayed on the monitor connected to the monochrome card, and the images are shown on the color-card monitor. In no case, however, should the IBM monochrome display be connected to the color graphics card. (Using a system with only one monitor, one switches back and forth between the images and the text displays.)

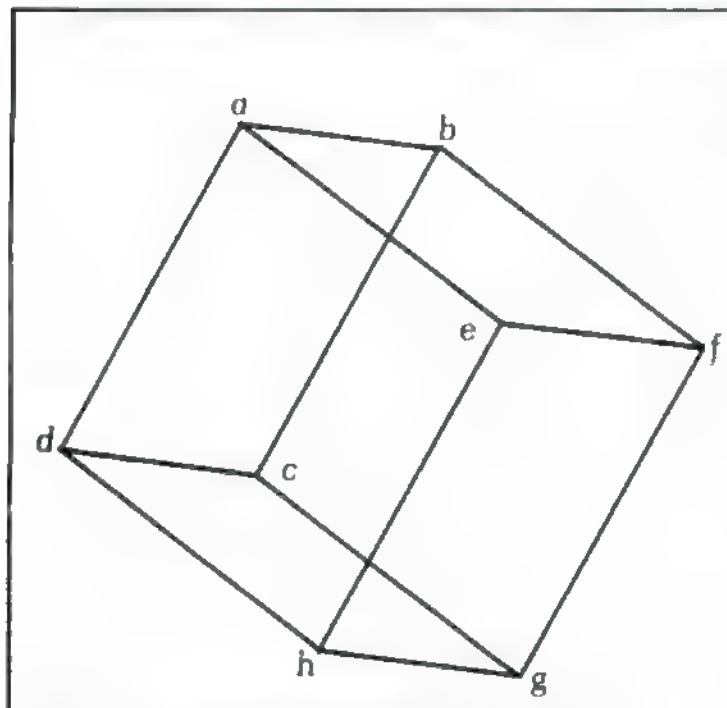


Figure 1: A cube rotated 15, 30, and 45 degrees, as printed with the MicroCAD *program.*

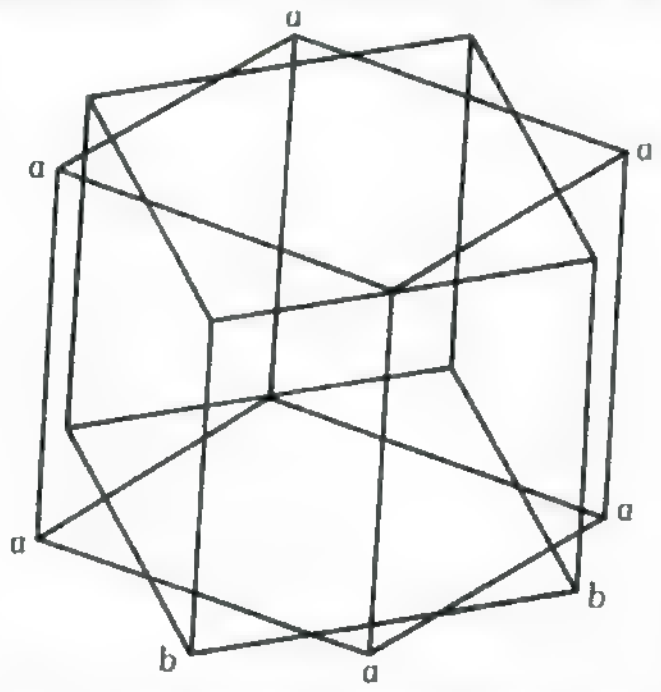


Figure 3: Two images of cubes, showing point and line intersections in the center foreground and background.

Figure 2: The chart of points, lines, bearings, and line lengths for the cube in Figure 1.

N	Act.	x	y	z	Bearing	Length
1	1	15.10959	-36.85194	-33.37117	N 22°17'39"E	39.82919
2	2	-20.38079	9.619206	-46.81981	S 37°22'09"W	58.47336
3	2	16.36156	46.36156	-16.81981	S 45°00'00"E	51.96153
4	2	51.85194	- .1095867	- 3.371172	N 37°22'09"E	58.47336
5	2	15.10959	-36.85194	-33.37117	N 45°00'00"W	51.96153
6	2	-16.36156	-46.36156	16.81981	N 73°11'12"W	32.87652
7	2	-51.85194	.1095867	3.371172	S 37°22'09"W	58.47336
8	2	-15.10959	36.85194	33.37117	S 45°00'00"E	51.96153
9	2	20.38079	- 9.619206	46.81981	N 37°22'09"E	58.47336
10	2	-16.36156	-46.36156	16.81981	N 45°00'00"W	51.96153
11	1	-51.85194	.1095867	3.371172	S 37°22'09"W	58.47336
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13	1	16.36156	46.36156	-16.81981	S 45°00'00"E	51.96153
14	2	-15.10959	36.85194	33.37117	N 73°11'12"W	32.87652
15	1	20.38079	- 9.619206	46.81981	N 37°22'09"E	58.47336
16	2	51.85194	- .1095867	- 3.371172	S 73°11'12"E	32.87652

Change (C)oordinates, (B)earing, (I)nsert or (D)elete?

Sidelines

The PC premiers the airwaves.

Two television programs recently featured the PC as part of their on-screen furnishings. One was national in scope and hosted by no less a financial media giant than Louis Rukeyser, on "Louis Rukeyser's Business Journal." Although Rukeyser didn't demonstrate *VisiCalc* or Dow Jones on the air, one of the guests he interviewed earlier this year was Don Estridge, IBM's PC spokesman.

The second PC-equipped program to hit the airwaves was a local San Francisco sports show, "Sports Today," presented live on Saturday afternoons and hosted by station KRON's Bill Orwig. As a regular feature of this program, Orwig dialed up The Source on his PC and gave viewers the latest sports scores.

For some reason, neither of these programs took hold with the viewing public and both are now off the air. Let's hope it wasn't the computer.

THE REAL computer revolution has been in small computers.

The program is written in BASIC and compiled into machine language for quick operation. Nelson was careful to plan the program so it can be used in a PC with 64K, although he will offer versions for systems with more memory as well. The 64K version is divided into three major program segments so the user can design, revise, and rotate images from the main menu and switch to another program segment to print an image or see the chart of coordinates for an image. Versions for PCs with larger memory will not require this program segmentation.

Calculate and Cut and Paste

Though its function is quite different, *MicroCAD* resembles both an electronic spreadsheet program and a word processor in certain ways. Figures 1 and 2 offer good examples of the spreadsheet-style operation of the program: The numeric values for all of the points and lines in the cube illustrated in Figure 1 are listed in Figure 2. If the designer changes one of those points, the image changes and any other points affected by this change are "recalculated." The program also has a utility that converts *VisiCalc* files for plotting as images; it enables the user to design complex geometric figures such as parabolas and hyperbolas.

The program resembles a word processor in its ability to allow "cut and paste" variations in designs. An architect could take a room off one side of a house plan,

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for instance, append that to another area of the image, and get an instant picture and point-set reading of the results without time-consuming sketching.

YOU'RE definitely transcending reality with the computer, and that's something that would be very difficult—if not impossible—to visualize.

Because *MicroCAD* allows users to print the images generated with the program (using an Epson-type printer with graphics capabilities), designers can have copies of each variation of an image for comparison and demonstration at their leisure. Although these are not working drawings, such preliminary designs could help both the architect and the client visualize what a room would look like or how a building will look on its site.

Johnson views the ability to do quick modeling and visualizing as a primary asset to anyone who works with design. Equally important, he believes, is the opportunity for a designer to see things that would be virtually impossible to imagine or draw with pencil and paper. He tells of experimenting with the program one evening and getting a good demonstration of an all but impossible image; he started with two cubes, rotated one by 30, 30, and 30 degrees and the second by 20, 20, and 20 degrees. When he appended the two images, he discovered that two of the points on one cube coincided with lines on the other cube (see Figure 3). "You couldn't model that or predict that geometric coincidence," he says. "If you had solid objects, you couldn't put one inside the other. It's a transcendant operation. You're definitely transcending reality with the computer, and that would be very difficult—if not impossible—to visualize."

Providing these tools is what Johnson set out to do in his career as an architect. He originally planned to write *MicroCAD* for his own use, but the program and its implications kept growing. "It started out as a program in BASIC to rotate three-dimensional forms. Then I started thinking about the design process. When you draw a square, you don't just sit down and draw a square. At least an architect or designer doesn't. You draw a line, take a point on it, measure a distance on it, and take a number from that. The number is more important than the drawing. What I set out to do was make something that would allow you to do both—enter the numbers and draw on the screen."

MicroCAD's development is nearly complete, and the program is currently being tested by other architects and designers. Johnson feels that creating this program has taken him a long way toward realizing his goal in working with computers. "I have wanted to create aids that make doing architecture easier." */PC*

For more information contact Nelson Johnson, Computer Aided Design, 764 24th Ave., San Francisco, CA 94121 (415) 387-0263.

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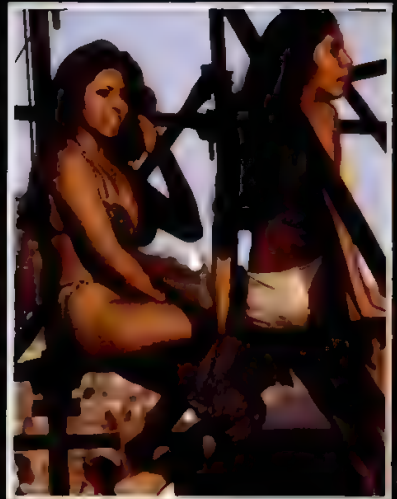
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huge panels of neon lights. On top of the stage was yet another mammoth video screen. Thus, it didn't matter that most of the crowd was too far away to see the performance with naked eyes because the video images were far more interesting.

Spotlights and laser lights were located in front of the stage and on the hills surrounding the concert site. During the night concert, these lights were skillfully used to create dazzling effects.

One disconcerting note was the event's commercialization, which at times was on a scale





BOOK REVIEW/LES COWAN

Forty Programs In BASIC

If you've got the time, and lots of it, this book has the listings.



Practical BASIC Programs, IBM Personal Computer Edition
Lon Poole, Ed. (OSBORNE/McGraw-Hill, Berkeley, 1982)
162 pages; $15.99

You may be a new PC owner bursting with desire to play with your marvelous new tool. You may, however, be afraid that programming is too difficult to learn or that buying programs on disks or tape is too expensive. You may therefore contemplate buying this book. My advice is get over your fears.

As the title indicates, this book includes listings of programs in the BASIC programming language. A listing, for those who do not know, is simply the program commands as the programmer originally wrote them. In this case the listing is committed to paper, although a program may be listed to a CRT (video terminal) or any other readable output device.

In the BASIC language, programmers write commands in the form of lines of text, one or more commands per line with each line numbered. Though a single language, BASIC has various "dialects." Programmers may write the same command in a somewhat different way in each dialect. Sometimes one dialect lacks a command that another provides. Dialects often reflect hardware differences among computers. Thus, IBM PC BASIC is slightly different from Applesoft BASIC, which is slightly different from TRS-80 BASIC.

FEW PC owners have uses for all the programs in this book.

Since variations among dialects are minimal, one dialect may be easily translated into another. This aids the publisher, who finds a much wider market for a general book of BASIC programs than for one written for a specific computer. And when a new computer comes along, the same book, with minor changes, may be sold to a new group of enthusiastic owners.

Publishers apparently find these program-listing books profitable because bookstores stock a large number of them. Such books certainly serve the new owner's desire to use his computer. If you know how to turn on your machine, you can use one of these books. You can sit down at the keyboard and spend hours laboriously typing in programs. Only later, when you have learned a little more about the world of microcomputers, will you realize that the most useful of these programs are available on disks and can be loaded into your machine in seconds instead of hours.

Exceptions exist, though. Some of these books of programs cover unusual utilities or special applications that are hard to find elsewhere. The book under review, unfortunately, is not one of these. It has listings for 40 programs, but the variety of these programs reduces its value. Although variety might seem a great selling point to a novice, few PC owners have uses for all the programs in this book. Some might use the household programs to balance their checkbooks, help calculate their income taxes, or predict the future value of investments. PC owners who are statisticians may use the programs that compute the factorial of an integer, calculate the sum of the Pth powers of the first N integers, or implement statistical estimation theory. Still other PC owners may use the program for determining the best time to switch from accelerated to straight-line depreciation of an asset or the one for projecting the future value of an investment through Markov analysis. Rare indeed is

the Renaissance personality who will have use for more than a fraction of the programs in this book, and that rare being will be the only buyer to get his or her money's worth.

The programs range in length from about 30 to 250 lines. Each program is preceded by a short introduction explaining its use but not the programming techniques involved. Samples of displays the program will generate, along with sample input and results, are also shown.

It took me 1½ hours to type in two programs: the checkbook reconciliator, a program of average length, and the unbiased estimator of standard deviation, one of the shortest programs in the book. Both were free of bugs, but neither took full advantage of the computer nor exhibited signs of professional program design standards.

The checkbook reconciliator, for example, does what you do on the back of your monthly bank statement. It adds up outstanding checks and deposits, compares the statement balance with your checkbook balance, and, if the adjusted balances are not reconciled, it tells you so. That's all the program does. It does not handle interest payments (possibly the original version of the program was written before interest-bearing checking accounts were available) nor will it handle automatic withdrawals or deposits. You must figure such transactions before you give your data to the computer. It will not check your addition or subtraction. When it has run, leaving several lines of text on the screen, it does not even clear the screen before running again, a flagrant violation of the simplest criteria of user-friendly program design.

RARE INDEED is the Renaissance personality who will have use for more than a fraction of the programs in this book.

The program for calculating standard deviation was just as bad. The introduction suggests that you can use this program to calculate the standard deviation of test scores. Standard deviation is calculated by applying a formula to the sum of the squares of a group of numbers. The resulting number is called the standard deviation of that group, or range, of numbers.

You would think the program would ask you to give it all the test scores. It would then square each of them, sum the results and apply the formula, freeing the teacher to concentrate on pupils' human needs. But no; this program asks for the summed squares, forcing the user to do most of the work. It then takes the summed squares and smugly produces a result. Big deal. A program that did everything you might expect would be much longer, would take a lot more time to type in by hand, and might discourage potential book buyers. */PC*

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BOOK REVIEW/LES COWAN

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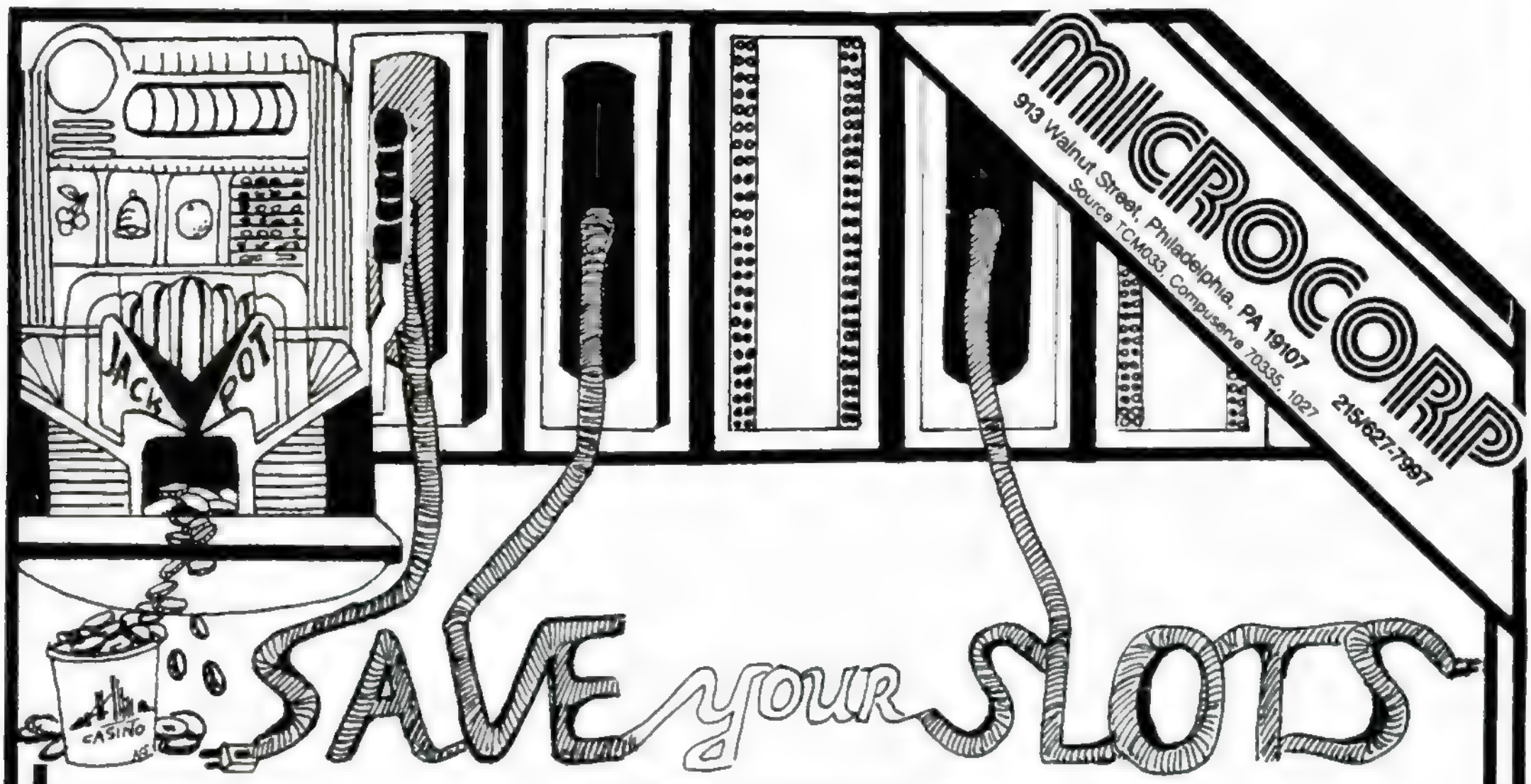
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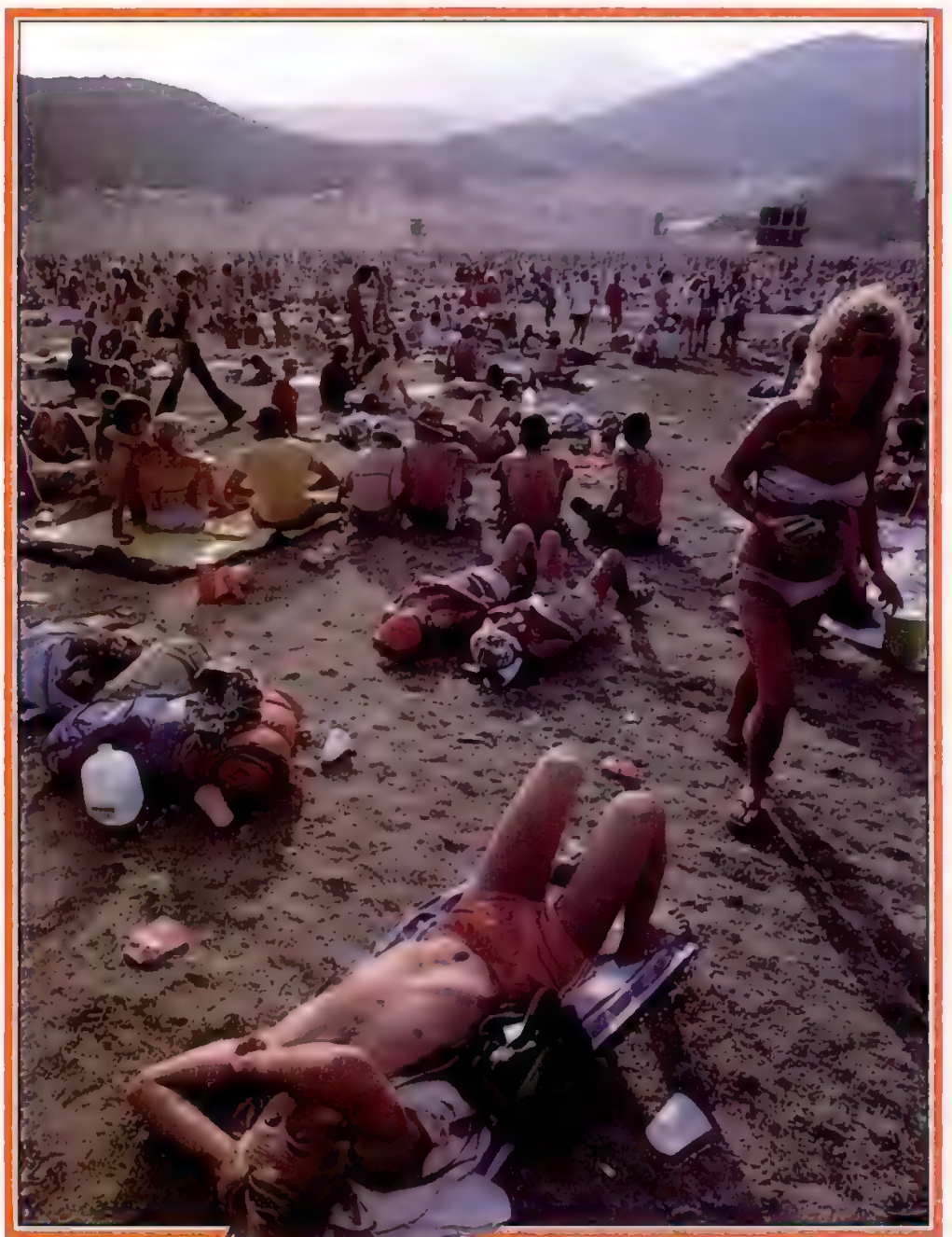
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PC At The US Festival

Photographs by Brian Dessin Day.
Twenty-five choking, sweaty PC employees and friends were dazzled by the laser lights and giant video screens at the US Festival's rock technology concert.







In September San Bernardino, located east of Los Angeles, is the armpit of California. Thick smog blends with temperatures in the 100s, and dust kicked up by people and automobiles makes an oppressive brew. With each breath, our lungs flushed with searing chemicals and suffocating dust particles.

Why San Bernardino was chosen to be the site of the US Festival will forever remain a mystery. However, in spite of this tremendous handicap, Apple Computer cofounder Steve Wozniac, who created and paid for the event, has to be congratulated for pulling off a truly unique and entertaining happening.

Being at the US Festival was like being on another planet. Where else could you find thousands of people squirting each other with water without showing a trace of hostility? This act, made possible by official US Festival spray bottles that sold for $1 each, became a new form of greeting. The usual response was, "Thank you very much."

That 100,000 plus people could be entertained for 3 days and nights in such a desolate place was a technological miracle. If they can do it in San Bernardino, someday they will be able to do it on the moon. The mass of humanity was shuttled in and out of the festival with little delay and with all their basic needs met, seemingly without a hitch. It was a miracle of organization and cooperation.



"IBM can make a personal computer, but it will never throw a rock concert," observed *PC* Assistant Publisher Jacqueline Poitier, summing up the relevance of the US Festival as far as personal computing goes.

The technology exhibit, in which *PC* participated, was not up to the level of computer shows such as NCC or the West Coast Computer Faire, reported in past issues. It was held in three air-conditioned tents and, though it included companies such as Apple and Commodore, the displays were low key and not particularly well attended. However, most exhibitors didn't seem to mind. Many booths were abandoned as exhibitors chose to attend the rock concert or walk around to observe the crowd.

The real technology at the US Festival was integrated into the rock concert. The stage, reportedly the biggest outdoor stage ever, looked as if it were constructed with giant tinker toys. Built along side it were two giant video screens and two correspondingly



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NEW

Software Breakthrough...

NEW *QUIKPRO + PLUS* WRITES PROGRAMS FOR YOU IN MINUTES ON *YOUR* Micro

Technical Review
by Wayne Hepburn

QUIKPRO + PLUS is a new breakthrough in software for microcomputers from ICR-FutureSoft.

Until now, whenever you wanted a new separate program in BASIC (Microsoft Basic/MBasic/Basic 80/Oasis Basic), you had to spend a lot of dollars for it, or a lot of hours creating it (if you have the know-how). That's all in the past now.

Anybody who can turn on a computer can write a program, quickly, with this new *Quikpro + Plus* software which generates programs for you. *Quikpro + Plus* is the invention of Joseph Tamargo of Florida. His brilliant approach to program writing allows you to tap the real power and speed of your microcomputer, and it is about time this happened.

I interviewed him to find out more about *Quikpro + Plus* and pass this valuable information to you. He told me "The best part of this software is that it gives you a separate custom program every time you use it. The resulting program is produced, error-free, in BASIC (Microsoft Basic/MBasic/Basic 80/Oasis Basic, as appropriate to your system) for you by *Quikpro + Plus*. What's more, you can list your new program, look at it, see what makes it tick, and modify it as you wish."

You can also, customize, enhance, alter, and even copy the programs you create with *Quikpro + Plus*. This is because programs created by *Quikpro + Plus* are structured, easy to follow, and include many REMARKS statements right in the program listing. I don't know of any other software with the flexibility and ease of use I found in *Quikpro + Plus*.

HUNDREDS OF APPLICATIONS...

For Education, Business, Hobby, Home, Science, Personal, etc. a partial list includes programs like these: Financial Forecasting, Expense Planning, Data Access and Retrieval, Modeling, Record Keeping of all kinds, Statistical Data Banks, and much, much more. *Quikpro + Plus* cuts the time it takes to generate a new custom program down to a few minutes. That's true. I saw a letter from a user who created a separate program in Basic within fifteen minutes after reading the clear, simple, complete Documentation & Operating Manual for *Quikpro + Plus*. The software will generate File Handling and Data Entry Programs in a file format, drawn right on the screen by user. Programs created by *Quikpro + Plus* produce standard ASCII Data Files allowing data to be easily accessed by other programs, other micro's, and even main frames.

HOW IT WORKS...

The operation of *Quikpro + Plus* is simple and easy. On your screen you answer questions which appear in plain English. The answers generate error-free Filing & Data Entry Programs for you...instantly. This completely eliminates the tedious and time consuming development you normally go through to write a program. Since the instructions are right on the screen you don't need any programming skills to operate *Quikpro + Plus*. Quickly, you get a fully independent new program ready to run on your system. After you create the new program you can remove *Quikpro + Plus* and stick it on the shelf until the next time you create a custom program.

PRINTS REPORTS & MANUALS...

There is a full report printing capability put into your new separate program by *Quikpro + Plus*. You can even print out in formats different from the File Format you used without altering the Record Data. Or you can selectively print portions of Files or selected fields from selected Records. Just about anything you want can be reported out from the Data Base associated with the new custom program you wrote.

PERFORMS CALCULATIONS...

You can perform all manner of computations among various fields in each record. You can selectively calculate and print resulting data only, or Data Base and results, or alter Records by calculation results, and so forth. The possibilities seem unlimited. And keep in mind that the power and features I am talking about end up in the separate new custom program *Quikpro + Plus* writes for you.

This software is ready to ship immediately and you can start writing programs the day you get in. In fact, ICR-FutureSoft guarantees your satisfaction or you can return it for a full refund in ten days after delivery. How's that for confidence? Mr. Tamargo said "There isn't any risk to us...our product *works* like it's supposed to work and users are very well satisfied. We are glad to guarantee satisfaction."

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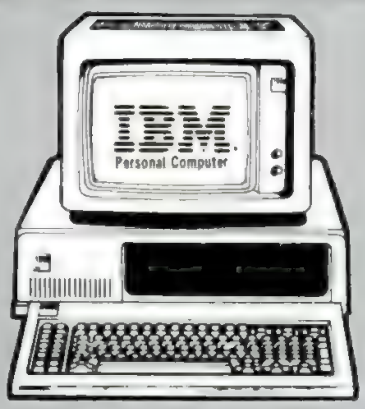
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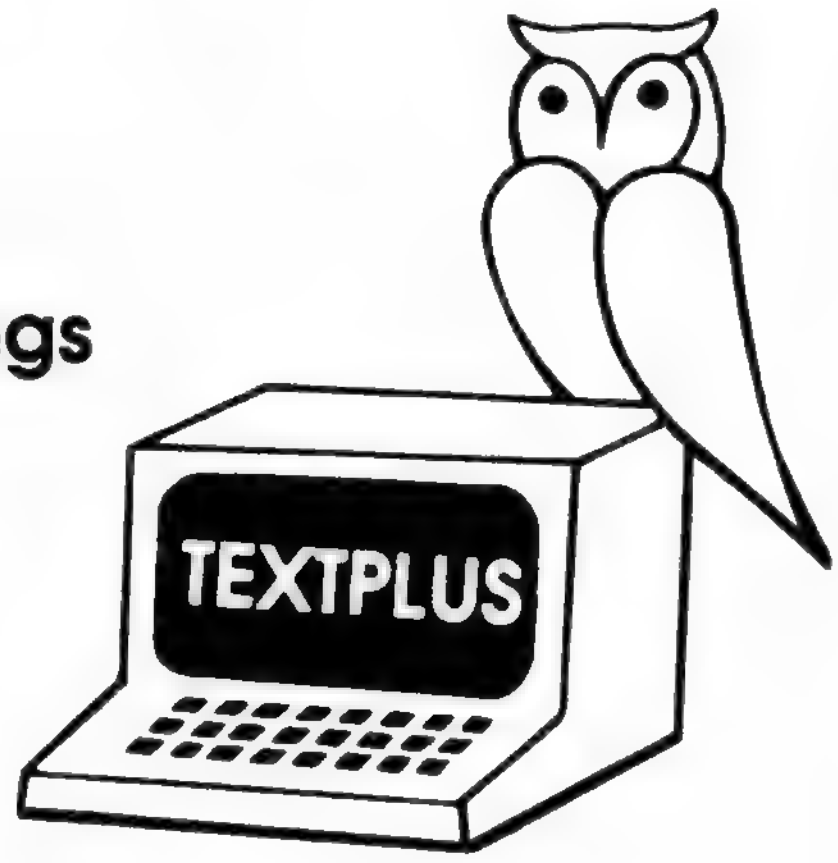
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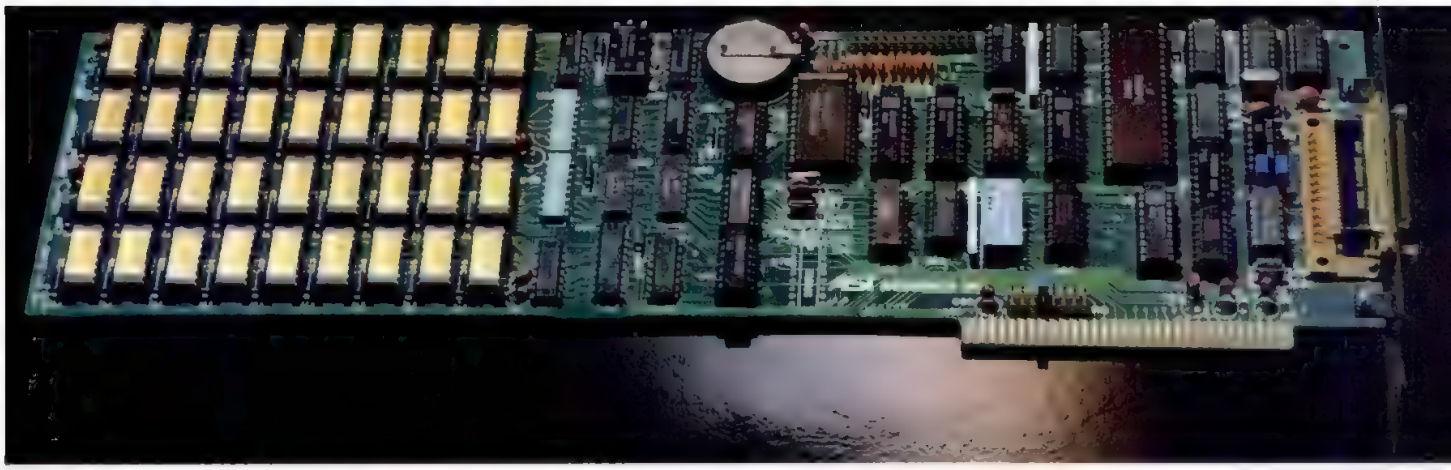
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Why pay hundreds more for a four (as in QUAD) function IBM PC board?

This may be the only board you need to expand your IBM personal computer. Standard with three functions; memory up to 256K, clock/calendar with battery back-up, and asynchronous serial (RS232C) port, (COM1 or COM2). On the same board a parallel printer port can be added for an extra $50. All the options you may ever need if you have the color graphics adapter. If you have the monochrome/printer adapter, you can save the $50, unless you plan to run two parallel interface printers. Or you may add this option later if needed.

No corner cutting here

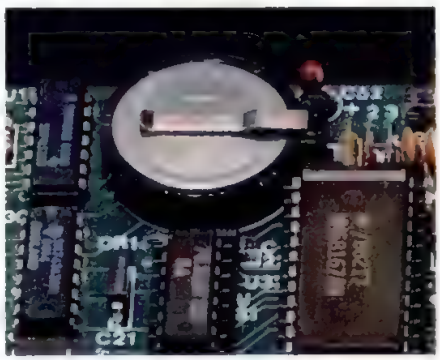
You may think that since this board costs so much less there has to be a catch. The catch is you have to put the board in yourself, and set a switch to tell your computer the board is there. It's all done in less than ten minutes. Our clear instructions with illustrations make it a snap. The board is a four layer design with rows of nine memory chips for full parity checking. Each board is solder masked, silk screened, and has gold plated contacts. The memory chip locations are all socketed. All components are premium grade, meet IBM performance specifications, and are burned in and tested prior to shipment. The highly rated design is well proven with several thousand boards in the field providing reliable service.

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The acid test

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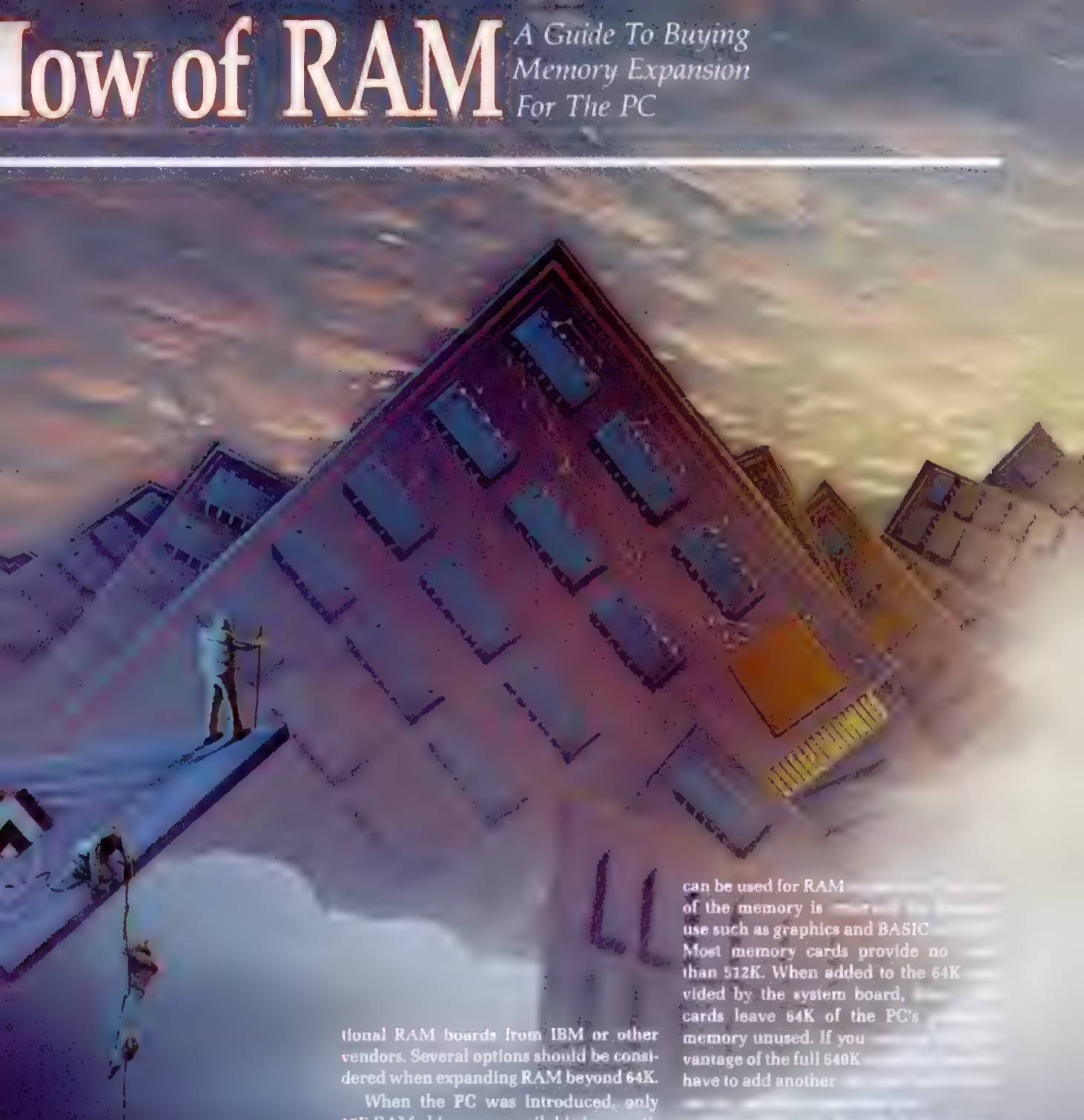
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low of RAM

A Guide To Buying Memory Expansion For The PC



Since the beginning of this year, the IBM Personal Computer has attracted the attention of 44 RAM board manufacturers. Interest in PC memory has been spawned by confidence in the future of the product as well as the potential power of the PC. The 8088 processor used in the PC can address over one million bytes of memory. Memory is measured in increments of 1,024 bytes, called 1K bytes or 1K.

Last fall IBM introduced the PC with sockets for up to 65,536 bytes (64K) of RAM on the system board. To extend the memory further, you have to buy additional RAM boards from IBM or other vendors. Several options should be considered when expanding RAM beyond 64K.

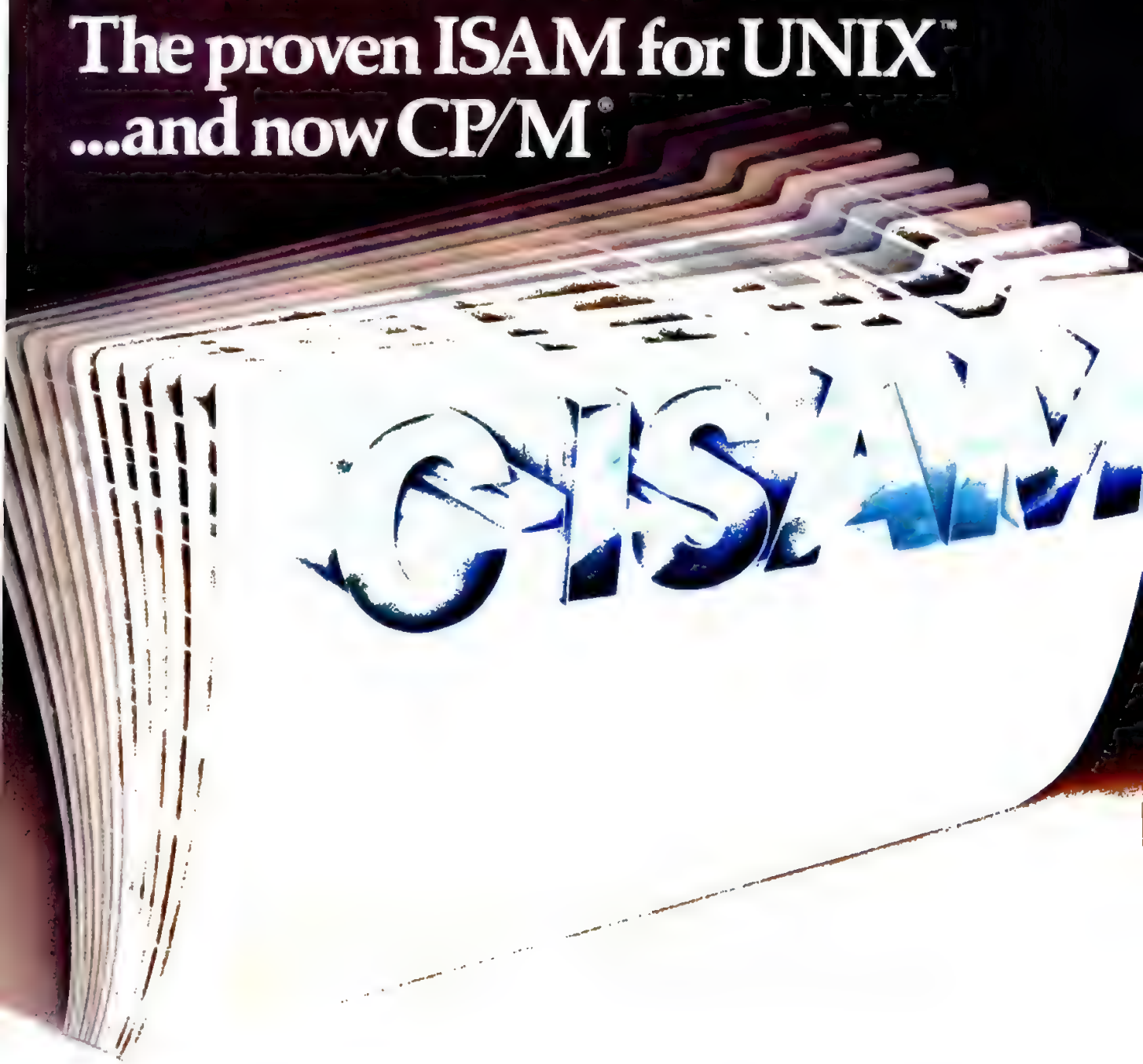
When the PC was introduced, only 16K RAM chips were available in quantity. Rumor had it that the PC had a maximum usable contiguous memory of only 256K. Several manufacturers produced RAM boards with 256K limitations. Competition drove the prices down. Some manufacturers offered boards socketed for 256K but filled only to 64K capacity so the buyer could comparison-shop for the best chip prices and then install them at home. What you lose with home installation is quality assurance; warranties cover only factory-installed memory.

The PC's 8088 microprocessor can address up to 1MB of memory, but only 640K can be used for RAM. The rest of the memory is reserved for use such as graphics and BASIC. Most memory cards provide no more than 512K. When added to the 64K provided by the system board, these cards leave 64K of the PC's maximum memory unused. If you want to take advantage of the full 640K, you have to add another

multifunction boards that have features including real-time clocks and serial ports (very nice, but not necessary for memory to function). You may choose boards with additional features for the conveniences they provide. Other design features are of real interest to the buyer. Some vendors offer "full speed operation with no wait states." With the exception of Tecmar's CMOS board, all RAM boards use dynamic RAM chips, which require refresh cycles that are generated automatically on

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the system board. CMOS is a static RAM board, so it has no need for refresh cycles. Other manufacturers advertise memory that is "addressable in 64K boundaries," a necessary feature if the user wishes to allocate some of the memory to noncontiguous addresses.

Price wars are prevalent as competition increases. Zobex advertised a 256K board for $998 and later offered a 40 percent reduction for a "limited time." Chreslin Industries has tried to keep the faith with its 256K board for $895 and has offered a $320 discount until July 31.

Some Options

Vendors have based RAM board prices on IBM prices instead of actual cost and profit margins. IBM set the pricing of its boards during the system's design phase when the cost was comparatively expensive. IBM's 32K board is priced at $325 and the 64K board is $540. Competitive pricing and advancing technology have reduced the price of a 64K board to $299.

Another option is to buy 16K or 64K chips and plug them into a bare board instead of buying completely filled boards. The 16K chips may be found for as little as $1.25. Discount vendors offer 64K chips for $8 or $9. If you install the chips yourself, buy a Dual In-Line Package (DIP) inserter/extracter kit. Using inserter tools reduces the risk of bending or breaking a pin, but some 64K chips have such flat sides that inserter tools won't hold them.

IBM sells a standard 16K memory expansion kit for $90, while other vendors sell memory expansion kits for much less. You may want to take advantage of other vendors' better pricing and added board function features, but keep in mind that you buy a proven track record for quality and service when you buy from IBM.

Multifunction Boards

Vendors add certain features to RAM boards, such as parallel and serial ports, hard disk interfaces, clock circuitry that keeps track of the date and time, and software that allows printer spooling, so you can continue to use the computer while the printer prints unattended. AST has a board that implements communication protocols so the PC can communicate with mainframe and minicomputers. Tecmar's Lab Master board enables analog-to-digital and digital-to-analog conversions.

The parallel printer port is the most

Comparisons for Memory Expansion

The following table lists vendors, size of memory expansion, and prices of many popular products.

SINGLE-CAPACITY, NONEXPANDABLE BOARDS

These boards do not have slots for additional chips.

Company	Features/Kits	Memory Size	Cost
COLUMBIA DATA PRODUCTS 8990 Rt. 108 Columbia, MD 21045 (301) 992-3400		128K 256K	$595 $995
CTI 965 W. Maude Ave. Sunnyvale, CA 94086 (408) 245-4256		256K	$695
DAVONG SYSTEMS, INC 1061 Terra Bella Ave. Mountain View, CA 94043 (415) 965-7130		64K 192K 256K	$299 $599 $729
IBM CORPORATION Systems Products Division P.O. Box 1328 Boca Raton, FL 33422 (305) 998-6007		32K 64K	$325 $540
INTERMEDIA SYSTEMS 10601 S. Saratoga-Sunnyvale Cupertino, CA 95014 (408) 996-0900		192K 256K	$579 $729
NATIONAL TECHNOLOGY SALES P.O. Box 401782 Garland, TX 75040 (214) 349-8259		256K	$729
PERSONAL SYSTEMS TECHNOLOGY, INC 22957 La Cadena Laguna Hills, CA 92653 (714) 859-8871		64K	$395
SEMIDISK SYSTEMS P.O. Box GG Beaverton, OR 97075 (503) 642-3100		512K 1MB	$1,995 $2,995
SIGMA DESIGNS INC P.O. Box 3765 Santa Clara, CA 95051 (800) 538-8157 ext. 929 672-3470 California		64K	$295
ZOBEK CORP 7343 J Ronson Rd. San Diego, CA 92111 (714) 571-6971		256K	$598

Continues

common addition to the RAM board because most people need such an interface, and the circuit design is well established and simple to implement. Tecmar, National Technology Sales, and Tall Tree Systems offer disk emulators—software that enables memory to emulate a disk for greater processing speed.

The PC has a total of five slots for boards—the maximum number possible with a 7-amp power supply. The system board uses 3 amps. Because of the limited number of slots and the 7-amp power supply, you may want to consider buying multifunction boards.

IBM doesn't seem to be a combatant in the price war. Competition has bred price and product enhancement advantages to the consumer. IBM offered the PC, but outside vendors provide the innovation and expansion of the system's capabilities at competitive prices.

Quality Assurance

News of product reliability often spreads throughout the marketplace like wildfire. Local PC user groups provide the best source for information about product reliability. Check warranties and read comparative hardware reviews. Consider buying from established manufacturers that have proven themselves in the micro and mainframe markets; they're likely to be around in a few years. An orphaned warranty has no value.

The bottom line when considering RAM expansion is whether or not you really need it. Some software products for the PC seem to be adaptations of existing programs rather than new programs that use the greater memory capacity of the 8088. */PC*

RAM Terminology

Following are terms you are likely to encounter while shopping for RAM expansion, and some definitions.

Amps

Abbreviation of Amperes, a measurement of electrical current, or power. The total amperage requirement of the circuitry within the PC must not exceed the capacity of the system power supply.

Comparisons for Memory Expansion

CMOS BOARD WITH BATTERY BACKUP

TECMAR, INC. 23600 Mercantile Rd. Cleveland, OH 44122 (216) 464-7410		32K	$995

FULLY SOCKETED, EXPANDABLE BOARDS

APPARAT INC 4401 S. Tamarac Pkwy. Denver, CO 80237 (800) 525-7674 (303) 741-1778		64K 128K 192K 256K	$425 $525 $625 $725
APSTEK, INC. P.O. Box 5306 Richardson, TX 75080 (817) 571-7171	 Expansion Kit Bare Board and Schematic Memory Diagnostic Disk	64K 128K 192K 256K 64K 256K	$289 $419 $549 $679 $139 $89 $19
AST RESEARCH, INC. 17925 Sky Park Cir., Ste. B Irvine, CA 92714 (714) 540-1333	 Expansion Kit	64K 128K 192K 256K 64K	$395 $595 $795 $995 $145
AUTOMATED BUSINESS MACHINES 29352 Avocet Ln. South Laguna, CA 92677 (714) 643-0439		64K 128K 192K 256K	$445 $625 $805 $985
BITSTREAM, INC P.O. Box 809 Loxahatcher, FL 33470 (305) 798-0025		64K 128K 192K 256K	$395 $500 $600 $703
BOULDER CREEK SYSTEMS 4859-C Scotts Valley Dr. Scotts Valley, CA 95066 (408) 438-4546	 Upgrade Kit	64K 128K 192K	N/A N/A $699 $140
CHRISLIN INDUSTRIES, INC 31352 Via Colinas #101 Westlake Village, CA 91362 (213) 991-2254		64K 128K 192K 256K	$675 $750 $825 $895
CONTROL SYSTEMS 2855 Anthony Ln. Minneapolis, MN 55418 (612) 729-2421	 Expansion Kit	64K 128K 192K 64K	$310 $420 $525 $108
CTI 965 W. Maude Ave. Sunnyvale, CA 94086 (408) 245-4256	With Chips Installed (Expandable to 512K)	256K 512K	$945 $1,195
DATAMAC COMPUTER SYSTEMS 680 Almanor Ave. Sunnyvale, CA 94086 (408) 735-0323	 Expansion Kit	64K 128K 192K 256K 64K	$449 $645 $840 $1,035 $195

DAVONG SYSTEMS, INC 1061 Terra Bella Ave. Mountain View, CA 94043 (415) 965-7130	(Expandable to 256K)	64K 128K 192K 256K	$350 $525 $700 $875
	Expansion Kit	64K	$175
DAYSTAR SYSTEMS, INC. 10511 Church Rd., Ste. A Dallas, TX 75238 (214) 341-8136	With Parity Disable Switch	64K	N/A
DG ELECTRONIC DEVELOPMENTS CO 700 S. Armstrong Denison, TX 75020 (214) 465-7805		64K 128K 192K 256K	$399 $579 $759 $939
	Expansion Kit	64K	$124
MACROLINK, INC. 1150 E. Stanford Ct. Anaheim, CA 92805 (800) 854-3332 (714) 634-8080		64K 128K 192K 256K	$490 $699 $899 $1,099
MAYNARD ELECTRONICS P.O. Box 3322 Longwood, FL 32750 (305) 869-8058		64K 128K 192K 256K	$295 $385 $470 $555
	Expansion Kit	64K	$110
MEMORY TECHNOLOGIES, INC. (MTI) P.O. Box 6 25 Main St. Twelve Mile, IN 46988 (219) 664-5741		64K 128K 192K 256K 320K 384K 448K 512K	$549 $664 $779 $895 $995 $1,095 $1,295 $1,295
	Expansion Kit	64K	$125
MICRO MATCH 10343 Commerce Ave. Tujunga, CA 91042 (213) 353-5929		64K 128K 192K 256K	$400 $510 $620 $730
	Expansion Kit	64K	$108
	RAM Test Program		$19.95
MICROSOFT, INC 10700 Northup Way Bellevue, WA 98004 (206) 828-8080		64K 128K 192K 256K	$495 $695 $895 $1,095
	Expansion Kit	64K	$200
MICROTEK, INC 9514 Chesapeake Dr. San Diego, CA 92123 (800) 854-1081 (714) 278-0633	Without Parity	64K 128K 192K 256K	$299 N/A N/A $749
	Expansion Kit	64K	$159
	Parity Add-On Kit		$46
	(Parity can be disabled once installed)		

Continues

Analog-to-Digital Converter
A device that produces a digital output from an input that is in the analog form of physical motion or electronic voltages.

Bit
An abbreviation for "binary digit." A binary digit is a single 1 or 0 in a binary number.

Board
An electronic circuit mounted on a stiff plastic-like card that slides into the PC's expansion slots.

Byte
A sequence of eight bits operated upon as a unit.

Chip
Small electronic components that contain microscopic circuitry.

Clock/Calendar
A device that keeps track of time and can be interrogated to determine the current date and time of day. A battery usually keeps the clock running when the power is off.

CMOS Memory
CMOS stands for complementary metal oxide semiconductor. It refers to the way the chip is made. A CMOS board consists of static memory rather than the dynamic memory used on other boards. Static memory does not have to be constantly refreshed to store data as long as power is applied. If batteries are used, data is retained even after the computer is turned off.

Disk Emulator
RAM that has been configured to receive and supply information as if it were a disk drive.

Dynamic RAM
RAM in which data must be refreshed periodically or it will be lost. Refreshing is done automatically by the PC.

Error-Correcting Memory
A feature built into a memory board that enables the board to detect an error, correct it, and allow the program to proceed.

Kilobytes
Though this term suggests 1000 bytes, it is actually equal to 1024 bytes.

K
An abbreviation for kilobytes.

MB
An abbreviation for megabytes. One

MB is equal to 1,485,760 bytes.

Memory Capacity
The maximum amount of data that can be used by a device. Usually defined in bytes.

Memory Expansion Kit
A set of memory chips that may be used to fill empty sockets on a RAM board, and thus increase the memory provided by that board.

Multifunction Board
A RAM board that in addition to memory includes features such as parallel or serial ports, clock/calendars, or hard disk interface.

Parallel Port
A port is a communications path into and out of a computer system over which data can be passed. A parallel port is one in which the bits of a data byte, or word, are passed in parallel. To pass one byte of data requires a single transfer.

Print Spooler
Software that enables the user to queue up documents for printing, and work on other tasks while those documents print.

8088 Processor
The "brain" of the PC. One chip within the PC contains the logic, which directs the flow of information among the other circuits. The part number of the chip is 8088.

RAM
RAM stands for random access memory and refers specifically to the read/write portion of computer memory.

ROM
ROM stands for read only memory and pertains to that part of memory the program can only read for information. A program cannot write data to ROM.

Serial Port
A port is a communications path into and out of a computer system over which data can be passed. A serial port is one in which the individual bits are passed sequentially, one at a time. To pass one byte of data would require eight individual bit transfers.

Sockets
Sockets allow chips to be installed and removed without soldering. The higher cost of socketed circuitry within the PC is usually offset by faster and less expensive repairs. */PC*

NATIONAL TECHNOLOGY SALES P.O. Box 401782 Garland, TX 75040 (214) 349-8259	(Expandable to 512K)	256K	$1,195
		64K	$299
		128K	$358
		192K	$487
		256K	$616
	Expansion Kit	64K	$129
PERSONAL DATA SYSTEMS, INC 1110 Wrigley Way Milpitas, CA 95035 (408) 272-7880		64K	$375
		128K	$535
		192K	$675
PERSONAL SYSTEMS TECHNOLOGY, INC 22957 La Cadena Laguna Hills, CA 92653 (714) 859-8871		64K	$395
		128K	$595
		192K	$795
		256K	$995
	Expansion Kit	64K	$165
QUADRAM CORP. 4357 Park Dr. Norcross, GA 30093 (404) 923-6342		64K	$395
		128K	$595
		192K	$795
	Expansion Kit	64K	$200
SIGMA DESIGNS, INC. P.O. Box 3765 Santa Clara, CA 95051 (800) 538-8157 ext. 929 672-3470 ext. 929		64K	$395
		128K	$560
		192K	$725
		256K	$895
	Expansion Kit	64K	$200
TALL TREE SYSTEMS 1036 Los Altos Ave. Los Altos, CA 94022 (415) 941-8748	With Disk Emulator and Double- and Quad-Density Disks	512K	$1,200
	Expansion Kit	64K	$100
TECMAR, INC. 23600 Mercantile Rd. Cleveland, OH 44122 (216) 464-7410		64K	$495
		128K	$749
		192K	$995
		256K	$1,295
	Expansion Kit	64K	$175
	Print Spooler (RAM Spooler) with Board		$40
	Disk Emulator (Speed Disk) with Board		$40
	Purchased Alone, each		$95
VISTA COMPUTER CO., INC. 1317 E. Edinger Santa Ana, CA 92705 (714) 953-0523		256K	$1,199
		320K	$1,349
		384K	$1,489
		448K	$1,619
		512K	$1,739
		576K	$1,949
	Expansion Kit	64K	N/A

MULTIFUNCTION, FULLY SOCKETED, EXPANDABLE BOARDS

ANTEX DATA SYSTEMS 2630 California St. Mountain View, CA 94040 (415) 941-7914		64K	$530
		128K	$715
		192K	$865
		256K	$1,015
		320K	$1,135
		384K	$1,255

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		576K	$1,595
		640K	$1,695
CHRISLIN INDUSTRIES, INC. 31352 Via Colinas #101 Westlake Village, CA 91362 (213) 991-2254	With One Serial Port	256K	$1,395
		512K	$1,595
MBI P.O. Box 16115 Irvine, CA 92713 (714) 552-0133 727-0202	With Two Serial Ports	64K	$495
		256K	$1,045
	Expansion Kit		$125
PERSONAL SYSTEMS TECHNOLOGY, INC. 22957 La Cadena Laguna Hills, CA 92653 (714) 859-8871	Fully Socketed; Two Serial and One Parallel Port	64K	$615
		128K	$815
		192K	$1,015
		256K	$1,215
	Expansion Kit	64K	$165
QUADRAM CORP. 4357 Park Dr. Norcross, GA 30093 (404) 923-6342	Serial and Parallel Port and Clock/Calendar	64K	$595
		128K	$775
		192K	$895
		256K	$995
	Expansion Kit	64K	$200
SEATTLE COMPUTER 1114 Industry Dr. Seattle, WA 98188 (206) 575-1830	One Serial Port	64K	$475
		128K	$675
		192K	$875
		256K	$1,075
	Expansion Kit	64K	$175
SIGMA DESIGNS, INC. P.O. Box 3765 Santa Clara, CA 95051 (800) 538-8157	One Serial Port	64K	$445
		128K	$610
		192K	$775
		256K	$945
	Expansion Kit	64K	$175
TECMAR, INC 23600 Mercantile Rd. Cleveland, OH 44122 (216) 464-7410	Clock/Calendar, Parallel and Serial Port, Encryption Decoder	64K	$575
		128K	$745
		192K	$995
		256K	$1,150
	Expansion Kit	64K	$175

ERROR-CORRECTING MEMORY

AST RESEARCH, INC. 17925 Sky Park Cir., Ste. B Irvine, CA 92714 (714) 540-1333	Serial and Parallel port	64K	$555
		128K	$755
		192K	$955
		256K	$1,155
	Expansion Kit	64K	$145
	Memory Diagnostic Disk		$15
	Parallel Port Upgrade		$35
DEALIN' ELECTRONICS 735 Loma Verde Palo Alto, CA 94303 (415) 493-5930		192K	$1,000
TRI STAR 1051 Elden St. Herndon, VA 22070 (703) 471-5910		64K	$699
		128K	$799
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Folcraft, PA 19032	Expansion Kit	64K	$189
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Z-80 CP/M CO-PROCESSORS

Four boards are listed because 648K of RAM is available to the 8088 when they are not running CP/M programs.

BYAD INC	DS1	$660
5345 N. Kedzie Ave.	DS2 with Serial Port	$760
Chicago, IL 60625		
(312) 539-4922		
QUALITY COMPUTER SERVICES	Big Blue with Clock/	$595
178 Main St.	Calendar, Serial Port or	
Metuchen, NJ 08840	Parallel Port, Hard	
(201) 548-2135	Disk Interface	
XEDEX CORPORATION	Baby Blue	$600
1345 Ave. of the Americas		
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(212) 489-0444		

MEMORY EXPANSION KITS

48K (27) chips are needed if a 16K system unit is purchased. At these prices try to get a warranty. You'll need 4116 250ns or 200 ns chips to do the job yourself.

APPARAT, INC	48K only	$75
4401 S. Tamarac Pkwy.		
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(303) 741-1778		
DATAMAC COMPUTER SYSTEMS	16K	$50
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Sunnyvale, CA 94086		
(408) 735-0323		
MAYNARD ELECTRONICS	16K	$25
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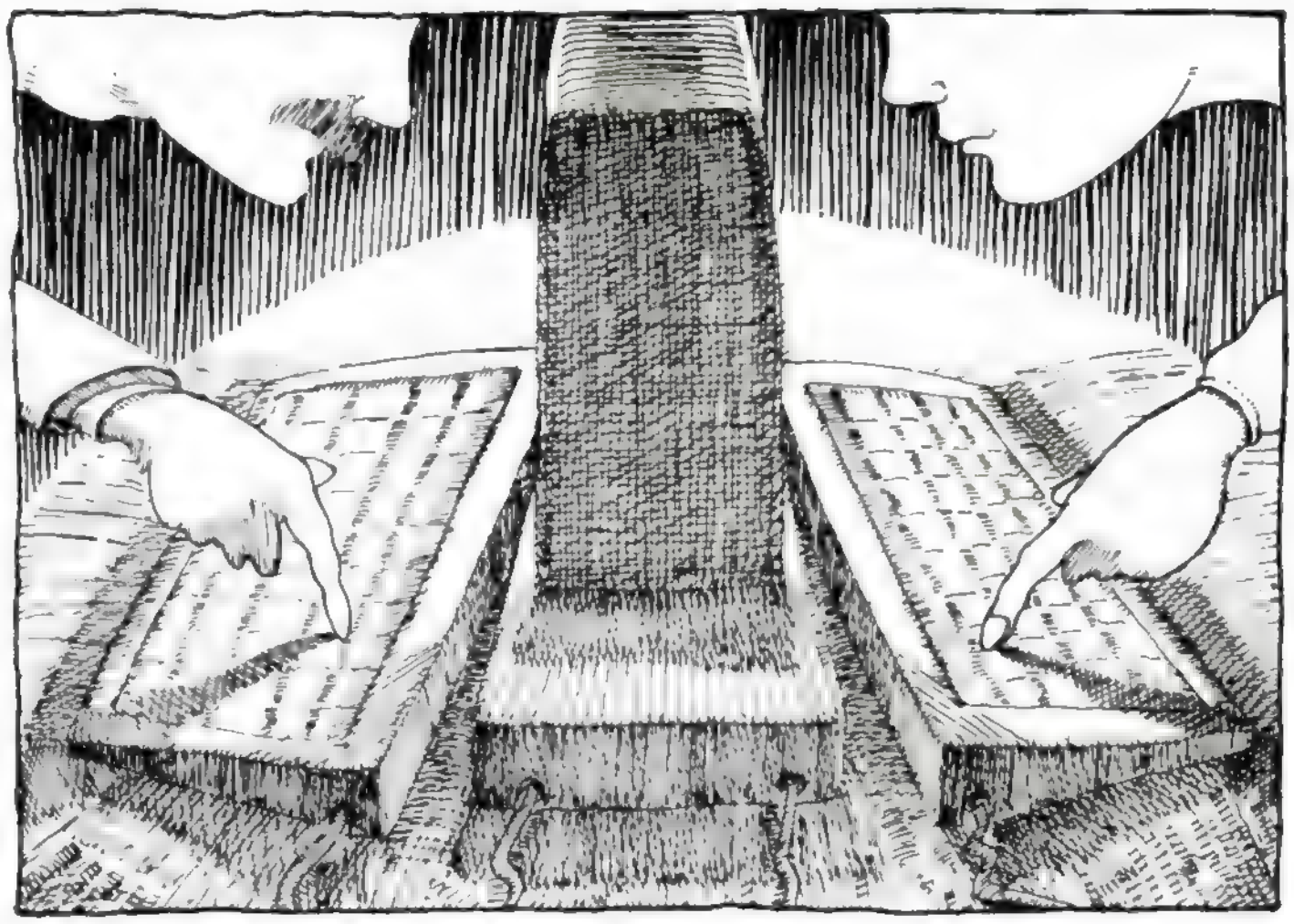
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EDITED BY ANDREW FLUEGELMAN

User-To-User

This month's collection of insights, tips, and occasional bugs, as reported by the PC user community.



The growing volume of User-to-User *submissions has inspired us to offer a few guidelines for those sending in material and those making use of it. Please check listings for accuracy before submitting them. We at* PC *will do our best to investigate or reproduce reported phenomena before publishing them, but it is impossible to determine whether a one (1) really becomes a zero (0) on the four-hundredth iteration, or to have access to every possible hardware or software combination. As yet we have not, to our knowledge, published an embarrassing inaccuracy, but one is likely to sneak in some month due to the nature of this column. Please do your best to spare us the embarrassment and spare readers from perplexity.*

You're all encouraged to share tips and routines that work, rather than reporting only bugs. Notifying users about potential problems is a worthy service, but the PC has apparently survived its birth trauma, and we're looking forward to seeing just how creative this new child of the Computer Age can be.

Finally, it's becoming apparent that this space can serve as a forum for the creative exchange of programming tips. On that positive note, we'll start with a couple of User-to-User *responses to previous items.*

Misinformed

In PC, August, 1982, Dr. Willard A. Brown claimed that the statements inside a WHILE . . . WEND loop always execute at least once; he was misinformed. If the conditional in the WHILE statement is false, program execution branches to the statement following the next WEND statement, period. The BASIC interpreter doesn't care how many times it has executed the loop (it probably doesn't even know that). The following illustrates the point.

```
list
10 WHILE A=1
20 PRINT "loop"
30 WEND
40 PRINT "end"
Ok
tron
Ok
run
[10][40]end
Ok
```

Variable A was never equal to 1, so lines 20 and 30 were never executed, Q.E.D. The WHILE . . . WEND loop is PC BASIC's incarnation of Dr. Brown's IF-THEN DO . . . END block structure. No need to waste variables in a FOR- . . . NEXT loop.

In the same issue David Lee presented two short programs that select the active display adapter, color or monochrome, when both are present. They work as advertised if microswitches 5 and 6 of SW1 are both off. True, those are the positions IBM designates for them when both adapters are present, but some users, lacking Mr. Lee's programs, may have resorted to resetting the switches every time they wanted to change monitors. If SW1 is set for the color adapter (microswitch 5 off and 6 on, or the reverse), the program that switches to monochrome will not work. Also, PC BASIC's SYSTEM command seems to reselect the monochrome adapter on its way back to PC-DOS.

Lon Poole
Oakland, California

BASIC Function Keys

Many users may have discovered that various control characters (ones with ASCII values less than decimal 32) can produce system commands as well as print special characters to the screen. Depending on which system mode (e.g., DOS) or program is being run, the results can vary. The following illustrates the effect of assigning a control character CHR$(2) through CHR$(31) to a string called by one of the special function keys F1 to F10.

Each control character can execute a

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string of cursor or screen commands. CHR$(13) is shown as an example in the BASIC Manual, but there are other undocumented functions.

```
CHR$(2)      gives move to previous word
     3               skip cursor line, re-
                     turn
     5               erase to end of line
     6               move to next word
     7               bell
     8               destructive back-
                     space
     9               tab
    10               skip, return
    11               home
    12               clear screen
    13               enter
    14               move to end of line
    18               insert mode
 21 or 27            erase cursor line
 28-31               move right, left, up,
                     down
```

Only 7, 9, 10, 11, 12, 13, and 28-31 give an action with PRINT.

CHR$(27) is useful to begin many usual commands, such as Run and List, since most of the time you get a syntax error if cursor line is not empty when you hit the Run or List key. Following is an example.

```
KEY 1,CHR$(27)+"List"+CHR$(13)
```

Also notice that List is easier to read on screen than LIST. The sequence

```
KEY 8,CHR$(13)+CHR$(14)+" '"+CHR$(9)
```

lets you edit a whole program line by line to add remarks.

Unfortunately, characters above 127 show correctly on the 25th line (if KEY ON is in effect) but are taken modulo 128 when you hit the function key. This means we lose a very easy way to use European and other special characters—é gives "move to previous word" or ñ gives "$".

Michel Poulin
Saint Leu la Forêt, France

CapsLock, NumLock, ScrollLock

If you often press a key on the numeric pad only to find you have moved the cursor instead, or vice versa, you may find the following BASIC statements useful additions to your program. If you can anticipate which mode of the dual-purpose keys will be needed at given points in your program, these programs allow you to have the program preset the keys to the proper status. A variation of this code allows you to control the status of the CapsLock, or both CapsLock and NumLock together.

To set NumLock on (so that pressing the keys in the numeric pad will result in the entry of numbers), include the following statements in your BASIC program.

```
DEF SEG = &H40 : POKE &H17, PEEK (&H17) OR
  32
```

To set CapsLock on (so capital letters will be entered without pressing the Shift key), change the number at the end of the above statement to 64. To set both CapsLock and NumLock on with one statement, change the number to 96.

To set NumLock off (so that pressing the keys will result in movement of the cursor), include the following as a numbered statement or statements in your BASIC program.

```
DEF SEG = &H40 : POKE &H17, PEEK (&H17) AND
  223
```

To set CapsLock off (so small letters will be entered unless you press the Shift key), change the number at the end of the above statement to 171. To set both CapsLock and NumLock off with one statement, change the number to 139. (Several concepts are packed into the above short lines of BASIC.)

The DEF SEG (define segment) part reflects the fact that the PC's 8088 microprocessor can make use of more than 1 million different memory cells (a megabyte), while the usual form in which memory addresses are handled by programs provides for only 65,535 (64K) possible addresses. DEF SEG lets you pick a 64K slice out of the theoretical maximum of a megabyte, and tell the program that it is the slice to which subsequent memory addresses in your program refer until told otherwise. (Thus, the same memory cell could be reached using different addresses, depending on where DEF SEG has defined the starting point for count-

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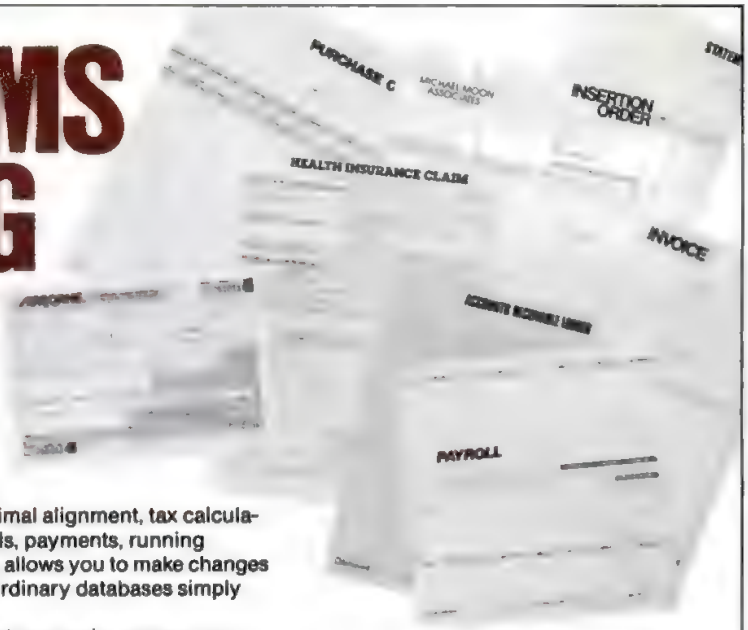
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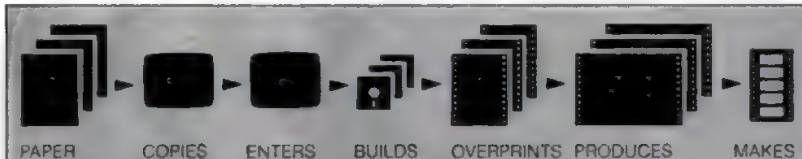
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ing.)

The "&H" preceding the number that follows DEF SEG indicates that the number is in base-16, or hexadecimal, notation, which programmers often find convenient when working at the "bits 'n' bytes" level. DEF SEG = &H40 points to the beginning of a section of memory cells where the PC stores details about its internal status. The 23rd cell in that group (17 in hexadecimal) is used to keep track of several matters concerning the keyboard status; each of the eight bits in the cell corresponds to one item.

Bit number 6 in the keyboard status cell keeps track of the current NumLock status: when the bit is 0, NumLock is off; when the bit is 1, NumLock is on. Bit number 7 achieves the same result for CapsLock. The other bits record such matters as whether one of the Shift or Ctrl keys is pressed at the given instant.

PEEK and POKE are BASIC commands used to deal with the contents of individual memory locations. The statements above use POKE to make bits 6 and/or 7 of the keyboard status byte either 1 or 0, as desired. However, since we want to change only one or two of the eight bits in the byte, we use PEEK to find out what's already stored in the status byte, and then use the "logical operators" AND or OR to change only the bit of interest.

In the POKE statement, the value before the comma tells what memory address (within the current DEF SEG) should be operated on; the part after the comma tells what value to place at that memory address. The PEEK statement gets the value that is already at the address (this time shown between the parentheses), and the remaining code tells how to modify the value before it is put back.

AND and OR are operations, similar to "plus" and "minus," that can be performed on binary numbers. They yield results according to rules you can study in full detail elsewhere if you are interested. Briefly, however, ORing a bit with zero results in 1 if the bit was one, and 0 if the bit was zero, thus leaving it unchanged. ORing a bit with 1 causes the result to be 1 no matter what the original bit's value was. The number 32 in binary form has a 1 in the fifth bit and zeroes in all other bits. Thus ORing an 8-bit number with 32 changes the fifth bit to 1 and leaves the others as they were. You should now be able to see the effects of ORing with 64 and 96 as well.

ANDing a bit with 1 yields a value of one if the original bit was 1, and zero if the original bit was 0. ANDing a bit with zero yields zero no matter what the original bit was. With this knowledge, you should be able to figure out how the above statements (using AND) act to turn off (make zero) the desired bits of the keyboard status byte while leaving the rest unchanged.

Jim Edlin
San Francisco, California

Printer Switch

PC owners who have two (or, by adaptation, three) parallel printer adapters, e.g., LPT1: on the Monochrome Display Board and LPT2: as the separate printer adapter, may find the enclosed programs useful to permit operation of two parallel printers without the bother, clutter, and expense of an A-B switch. For example, one could use an Epson-100 on the separate printer adapter for drafts, and a letter quality printer on the Monochrome Display/Printer Adapter for final output.

The following program switches addresses so that the PC outputs LPT1: text



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on LPT2: and vice versa. Once run, the program holds in DOS, but rebooting returns all to normal. The program can easily be called by an AUTOEXEC file to run when DOS is booted.

```
10 REM this program switches the port
   addresses of LPT1: and LPT2:
40 DEF SEG=&H40
50 POKE &H8,&H78
60 POKE &H9,&H3
70 POKE &HA,&HBC
80 POKE &HB,&H3
```

The next program reverses the change, restoring printer output to normal.

```
10 REM this program restores the normal
   ports addresses of LPT1: and LPT2:
40 DEF SEG=&H40
50 POKE &H8,&HBC
60 POKE &H9,&H3
70 POKE &HA,&H78
80 POKE &HB,&H3
```

For those interested, debugging at 40:0 F will show printer address status. With both adapters installed, the line 0040:0000 shows the following status.

```
Normal: 00 00 00 00 00 00 00 00-BC 03 78 03 00
   00 00 00
Reversed: 00 00 00 00 00 00 00 00-78 03 BC 03
   00 00 00 00
```

L. Robert Primoff
New York, New York

A Quirk, a Bug, and a Crash

An interesting quirk in all present versions of IBM PC BASIC follows: Enter the line 10 A = .005. Then list the line. You'll see "10 A = 5.000001E-03". Change the line to read: "10 A = 5.000000E-03". Once the line has been changed, list it to show: "10 A = .005". This quirk also shows up using .009.

Chris Kantack
Belle Plaine, Iowa

Controlling ScrollLock

Making use of the same concepts as Jim describes so well, you can also control operation of the ScrollLock key.

```
DEF SEG= &H40 : POKE &H17,PEEK (&H17) AND
   239 will turn SCROLL LOCK off.
DEF SEG = &H40 : POKE &H17,PEEK (&H17) OR 16
   will turn SCROLL LOCK on.
```

Note also that decimal 64 is the equivalent of &H40 and that decimal 23 is the equivalent of &HL17. So any of the foregoing statements could also be written

```
DEF SEG = 64 : POKE 23, PEEK (23) AND . . .
   (etc.)
```

Michael A. Wiles
Dallas, Texas

BASIC File Check

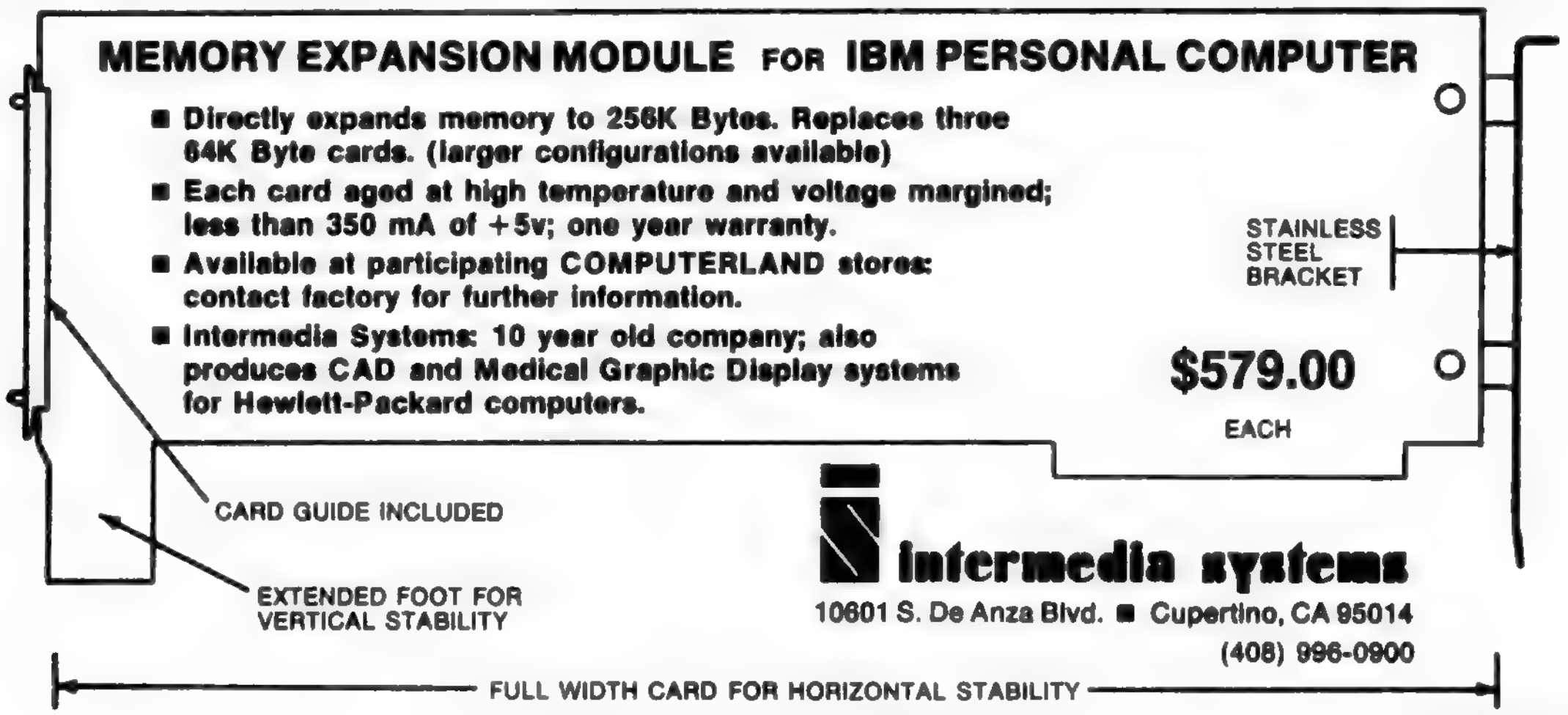
At times you may want to check that an output file you are writing will not overwrite an existing file on the system. In BASIC there is no direct method to obtain directory information to see if a certain file exists or not. The following code can be used to see if a file is present. If it is, it will permit the file to be appended (assuming it is a sequential file).

```
100 INPUT "Enter the name of the output
   file-",F$
110 ON ERROR GOTO 140
120 NAME F$ AS F$
130   The previous statement will always
   cause an error!
140 X=ERR: RESUME 150
150 ON ERROR GOTO 0
160 IF X=53 THEN 260 ELSE IF X<>58 THEN
   PRINT"Unexpected Error "ERR: STOP
170 PRINT "File "F$" already exists. Do you
   want to:"
180 PRINT "       1. Enter a different file-
   name"
190 PRINT "       2. Overwrite this file
   with the new data"
200 PRINT "       3. Append to the file with
   the new data"
210 PRINT "       4. Exit the program"
220 INPUT "            Enter your choice
                    (1, 2, 3, or 4)
                  - ",X
230  IF X>0 THEN ON X GOTO 100, 260,
     250,280
240  BEEP: GOTO 220
250  OPEN F$ FOR APPEND AS #1: GOTO 270
260  OPEN F$ FOR OUTPUT AS #1
270    Now write to the file!
280  CLOSE: END
```

The attempt to rename the file as itself on line 120 of the program will always cause an error since the file will either not be found or will already exist. Control will be directed to line 140 of the program when this error occurs, at which time the error is saved in variable "X," the error routine is exited (RESUME

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When the program is run, the screen will display the "IBM/EPSON PRINTER OPTION MENU." You may select as many options as you wish, but you must press [ENTER] after each selection. Be sure the printer is on. Once you select an option it will remain in effect until you cancel it or turn off the power to the printer.

The best way to see the results of the program is to experiment. Type in the program, save it, and then select an option and print something. You may want to use parts of this program within some of your other programs. The important parts are those that LPRINT an ESCAPE code (CHR$(27)) and the appropriate action code. You may also wish to use an AUTOEXEC file to set the printer mode automatically whenever you start your PC.

Linda and Sid Broudy
Brooklyn, New York

```
10  REM — IBM PRINTER OPTION PROGRAM
20  REM — BY LINDA AND SID BROUDY
30  CLS
40  PRINT ''IBM/EPSON PRINTER OPTION MENU''
50  PRINT:PRINT ''Choose from the following options:''
60  PRINT
70  PRINT '' 0) End program''
80  PRINT '' 1) Regular characters (default)''
90  PRINT '' 2) Compressed characters'
100 PRINT '' 3) Regular mode (default)''
110 PRINT '' 4) Emphasized mode — regular characters only''
120 PRINT '' 5) Double-strike mode
130 PRINT '' 6) Emphasized double-strike mode''
140 PRINT '' 7) Normal line spacing (default)'
150 PRINT '' 8) Compressed line spacing''
160 PRINT '' 9) Silence paper-out buzzer''
170 PRINT
180 INPUT ''Which option do you wish'';ANS
190 IF ANS<0 OR ANS>9 THEN BEEP GOTO 180
200 IF ANS=0 THEN 340
210 ON ANS GOSUB 250,260,270,280,290,300,310,320,330
220 PRINT   Done
230 FOR DELAY = 1 TO 1000:NEXT
240 GOTO 30
250 LPRINT CHR$(18);:RETURN 'Set regular characters
260 LPRINT CHR$(15);:RETURN 'Set compressed characters
270 LPRINT CHR$(27);''F'';CHR$(27);''H'';:RETURN 'Emphasized & double-strike off
280 LPRINT CHR$(27);''E'';:RETURN 'Emphasized mode
290 LPRINT CHR$(27);''G'';:RETURN 'Double-strike mode
300 LPRINT CHR$(27);''E'';CHR$(27);''G'';:RETURN 'Emphasized & double-strike on
310 LPRINT CHR$(27);''2'';:RETURN 'Normal line spacing
320 LPRINT CHR$(27);''O'';:RETURN 'Compressed line spacing
330 LPRINT CHR$(27);''8'';:RETURN 'Override paper-out condition
340 END
```

150), and the ON ERROR is reset. If the file was not found (ERR=53), control will continue to line 260 to open the file for output. If the error was not 58 (file already exists), some other error occurred; this example will print the error that occurred, and the program will stop.

If your program uses the ON ERROR for other purposes, that routine could set a flag indicating the duplication of the file name and could then RESUME to the next line. Following is an example.

```
100 ON ERROR GOTO 900
110 FALSE=0: TRUE=NOT FALSE
120 INPUT "Enter the name of the output
  file-",F$
130 NAME F$ AS F$
140 IF NOT DUPFLG THEN 260
150 'A file is present whose name dupli-
  cates the one entered
160 'Do what is necessary
250 '
250 OPEN F$ FOR APPEND AS #1: GOTO 270
260 OPEN F$ FOR OUTPUT AS #1
270 'Now write the file!
280 CLOSE: ON ERROR GOTO 0: END
900 'Error routine
910 IF ERL=130 THEN DUPFLG=FALSE: IF
  ERR=58 THEN DUPLFG=TRUE: RESUME 140
  ELSE IF ERR=53 THEN RESUME 140
920 PRINT "Error" ERR "at" ERL: STOP
```

This method is effective and can prevent overwriting files you want to keep.

Brad Hanson
Bettendorf, Iowa

The IBM-Microsoft entomologists evidently have not yet discovered and cataloged all the BASIC bugs. Try the following program:

```
10 A#=0
20 A#=-A#
30 PRINT FIX (A#),INT (A#)
```

According to the definition of the FIX and INT functions, FIX is supposed to return the argument with all numbers to the right of the decimal place removed, and INT returns the greatest integer not greater than the argument. Therefore, you would expect the above program to print two zeroes since A# should have a value of zero. However, two -1s are printed by PC-BASIC (Version 1.00), which is definitely the wrong answer. The same result will occur if line 20 is written A#=A#-0.

IBM PC-BASIC is a slightly modified version of Microsoft BASIC-80, and it is interesting to note that the bug also appears in BASIC-80 version 5.1 but not in the earlier version 4.51 or the later version 5.2. (Other versions have not been tested.)

Dumping some memory with the debugger seems to reveal that line 20 in the program causes the double-precision



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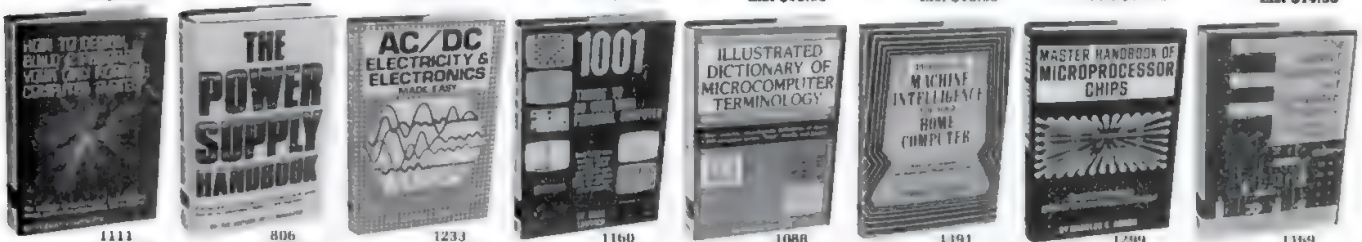


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value A# to be stored in memory as a zero with a minus sign. This, in turn, must confuse the FIX and INT functions enough to cause the error. Other BASIC operations are affected as well. The logical statement A#=0 yields a zero or "false," indicating that A# is not zero. On the other hand, the function SGN(A#) does yield zero, which indicates that A# is zero and has no sign. This bug is present for only double-precision values and does not occur with simple, single-precision variables.

Since the SGN function seems to agree that A# is zero, programmers can avoid getting into trouble with the following rather cumbersome substitution:

```
ABS(FIX(A#))*SGN(A#)
```

All this statement does is strip the sign of the number with ABS and then put it back by multiplying by SGN. If SGN(A#) is zero, multiplying by zero forces a zero, regardless of what is returned by FIX. Substituting INT for FIX works the same.

Burks A. Smith
Shawnee Mission, Kansas

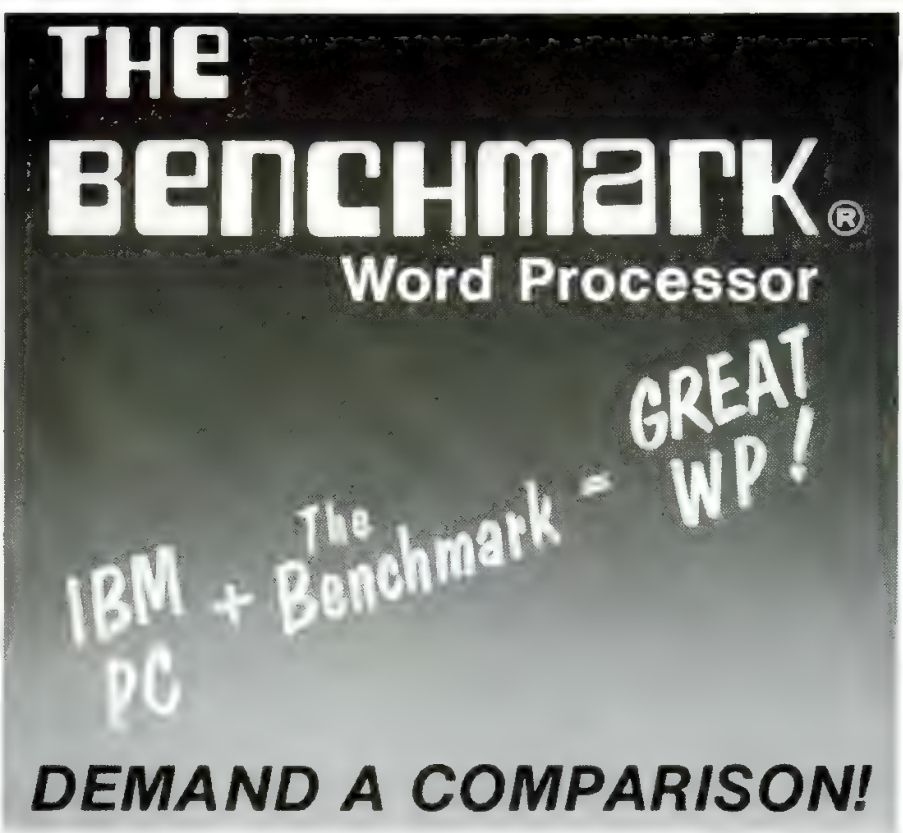
Perhaps the most concertedly diabolical crash routine yet devised has been reported by William Terrell of Davong Systems. You're not likely to stumble upon this problem accidentally (at least not as reported); however, some file access problem does seem to be lurking within DOS. The procedure for forcing the system hang-up is reproduced below. If any readers have experienced another tip of the same iceberg, perhaps they can offer more enlightenment. The procedure to make the system hang follows.

1. Boot the system with DOS 1.10 and type BASICA
2. Set Function Key 1 to display the disk files on the volume. I type: KEY 1, "files"+chr$(13).
3. Hit [F1] once to make sure the files are, in fact, displayed.
4. Hold down [F1] until the keyboard buffer is full and the PC beeps at you madly.
5. Release the key and watch the disk access light. When it is on (most of the time), hold down [F1] again until the keyboard buffer is full again. If the disk access light is still on, continue to hold down F1 for about 5 seconds. If the disk access light stays on during this time, you have probably succeeded. If not, go to step 3 again; it takes only two or three tries to make the system crash.
6. Release [F1]. The system will be hung up; the disk light may stay on (not always), but the display of the directory files will have stopped. You cannot free the system without turning off the power.

SOME FILE access problem does seem to be lurking within DOS.

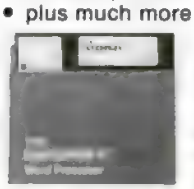
This may be just one symptom of more acute file access difficulties. For example, it has been reported that when writing random files to disk, the first 26 writes are successful, but the 27th will occasionally cause the system to crash in the same way as the function key crash described above.

William Terrill
Mountain View, California



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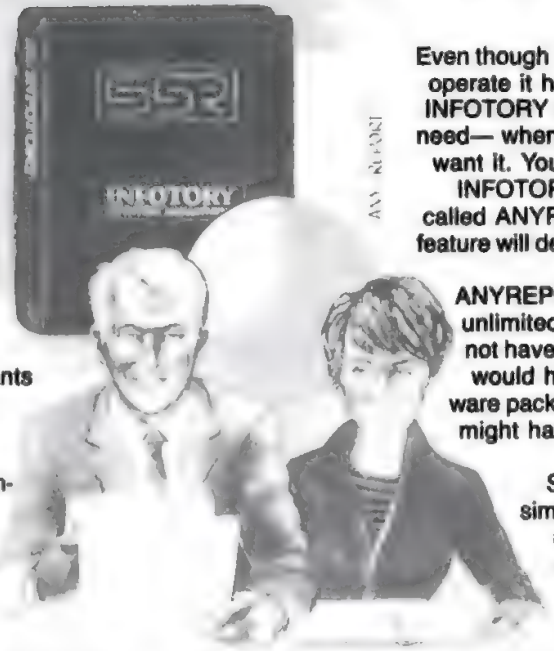
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FORTRAN, Anyone?

The PC FORTRAN Compiler was released by IBM in April 1982. The following program briefly introduces the normal structure of a FORTRAN program valid both in FORTRAN IV and in the newer American National Standard (ANS) FORTRAN, sometimes referred to as the FORTRAN 77. A main program calling a subprogram or a function would be structured:

```
      program Main
c     Assignment Statements; Execution
      statements;
c     eg:
      n=1
      a=1.0
      b=10.0
c     Subprogram calling statement
 20   call sub1(a,b,c)
      n=n+1
      write(*,15)n
 15   format( I4)
      go to 20
      stop
      end
```

```
c     subroutine sub1(a,b,c)
      c=a+b
      write(*,10)c
 10   format( 'c=',f10.2)
      return
      end
```

Whenever calculations of a repetitive nature are involved in the program (e.g., trial and error calculations) using a subprogram, the IBM PC runs out of storage space irrespective of the size of the user's program. If the above were programmed on the IBM PC and compiled and run, the PC would run out of storage space after about 800 to 900 calls to the subprogram (depending upon the PC memory size). Normally the above program should run indefinitely unless stopped by the user by an external break command, because the program requires the computer to store only four variables. A bigger program would cause the PC to run out of dynamic storage much faster.

After several trials and hours of program debugging, I discovered that the RETURN statement on the IBM PC FORTRAN compiler was faulty and caused this "Heap Overflow" problem. Simply deleting this statement from your subprograms would allow you to run your FORTRAN programs normally.

Users of IBM PC with the FORTRAN compiler will sooner or later run into this problem (overflow) if they ever have to use large FORTRAN programs on their PC. This tip should save them hours or days of agonizing program debugging without finding errors in their programs.

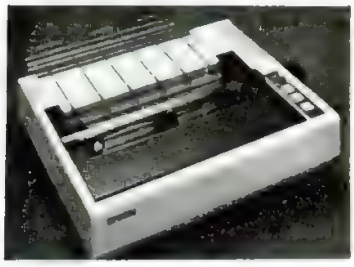
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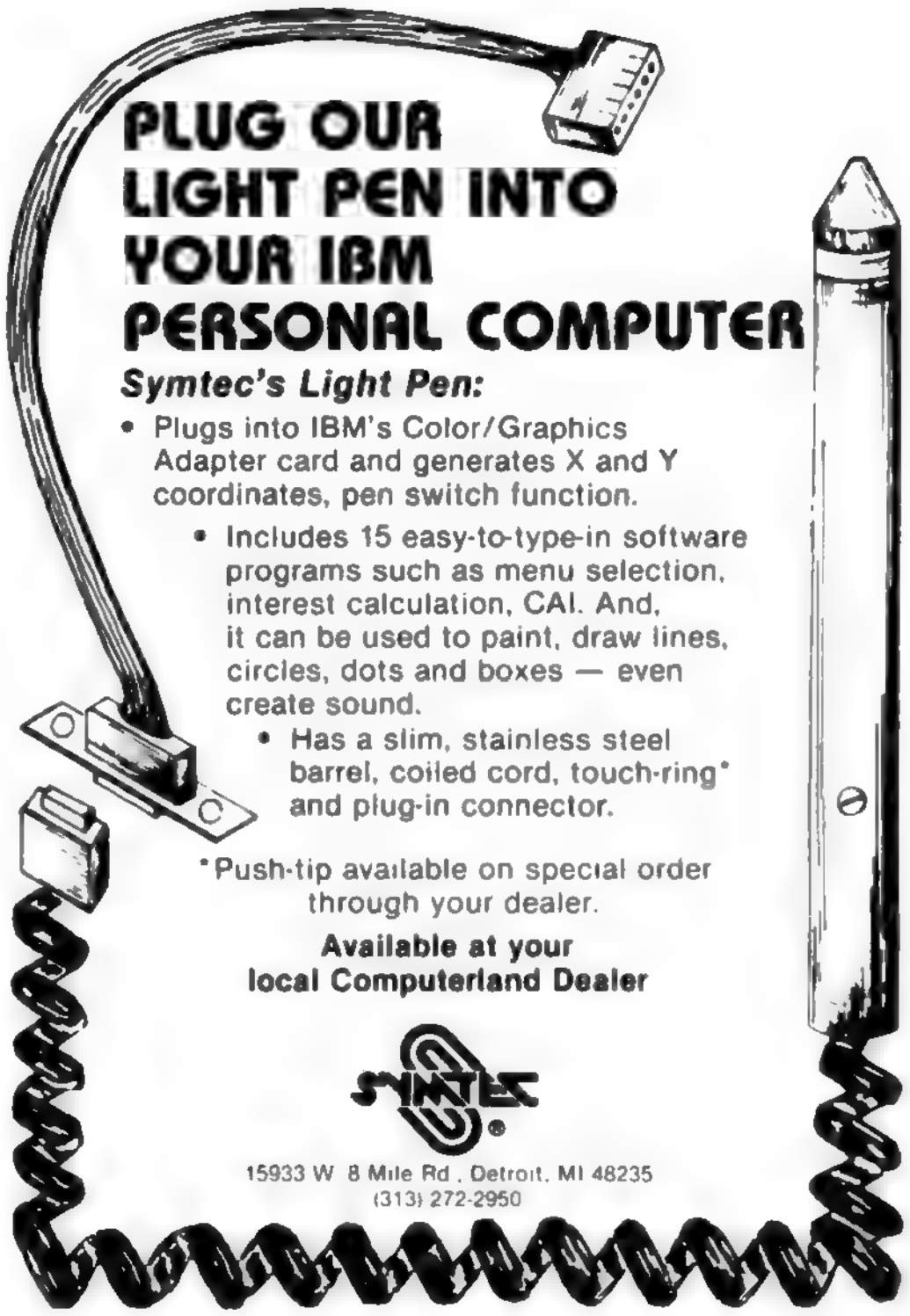
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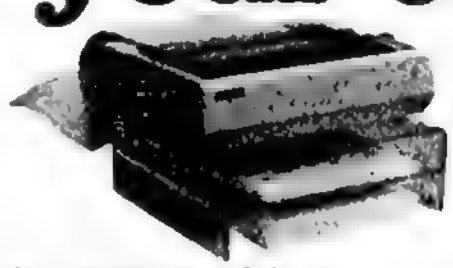
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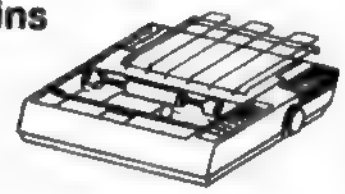
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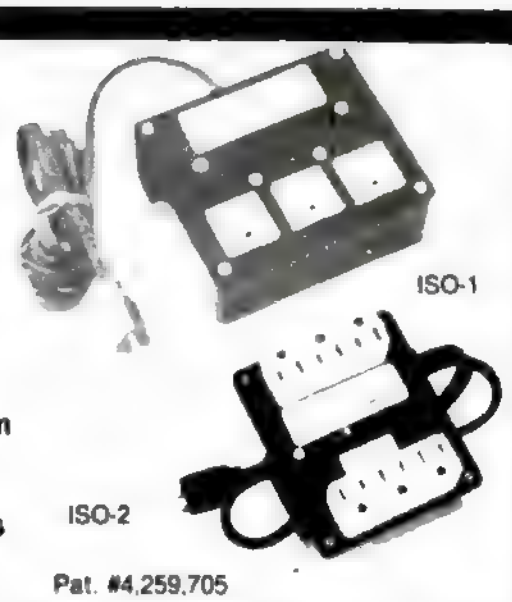
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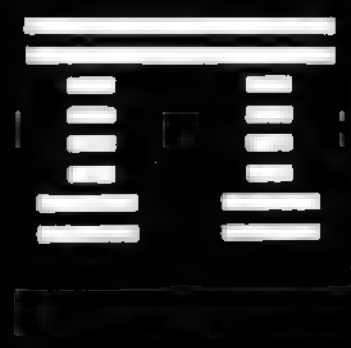
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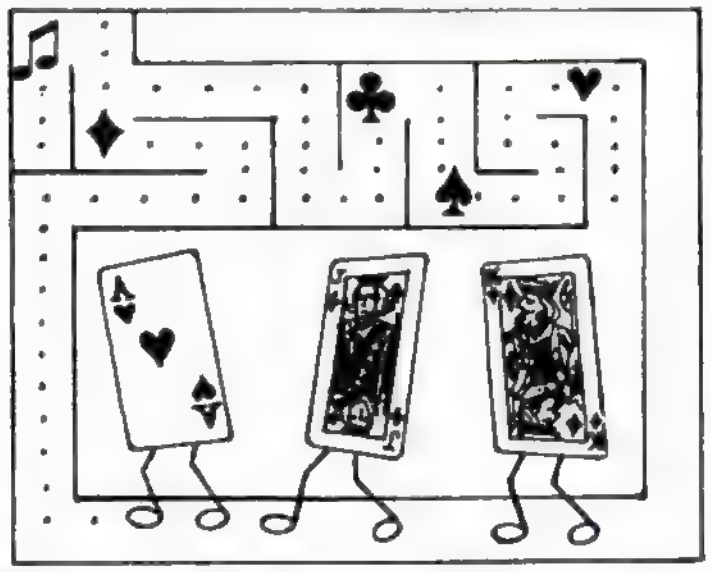
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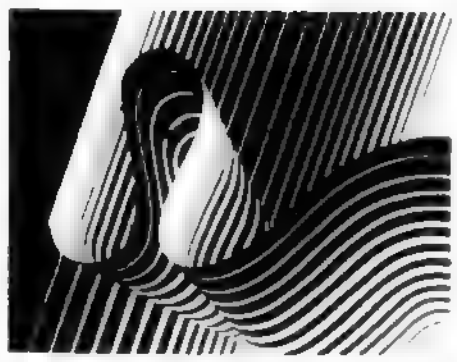
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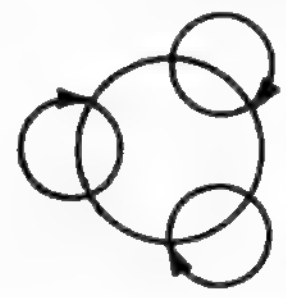
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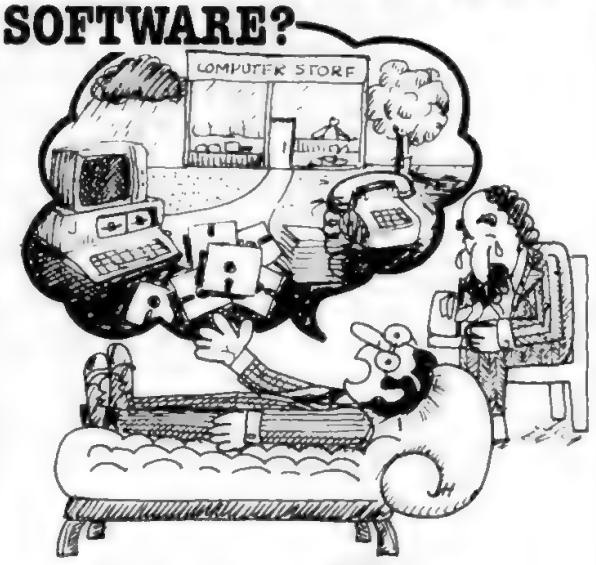
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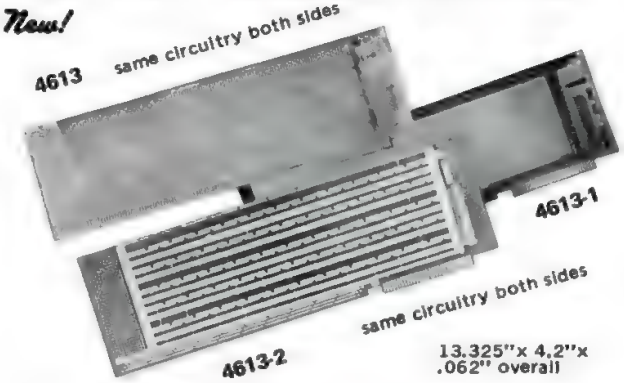
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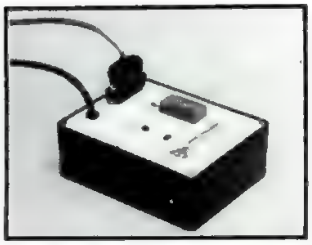
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Club News

Clubs, bulletin boards, and newsletters enable PC users to capitalize on their fellow users' knowledge.

Arizona

Charter member dues are $5 for the IBM PC User Group of Tucson, Arizona. Members receive copies of the newsletter, *Bits and PCs*, and access to the group's software library. Group meetings are held the third Tuesday of each month. Contact Theresa Baudier, P.O. Box 1489, Tucson, AZ 85701 (602) 622-4751.

California

The IBM Users' Group of California wants to exchange software and newsletters with other clubs. The group started in January of this year and holds meetings on the third Tuesday of each month. Meetings feature computer industry speakers who discuss their products and recent developments in the industry. Contact Neil Zachary, P.O. Box 4136, Los Angeles, CA 90028 (213) 937-1314.

The new president of the Beach Cities IBM-PC Users Group is Richard Rube of Irvine, California. Meetings are held on the last Wednesday of each month. Contact Richard Rube, 18 Rana, Irvine, CA 92715.

The San Diego IBM PC Users Group does not hold regular meetings but communicates via telephone and a monthly newsletter. Members provide each other with technical assistance, exchange software, and cooperate for group purchase discounts on hardware. Contact Tom Albright, 4005 Isle Dr., Carlsbad, CA 92008 (714) 434-1608.

Connecticut

Recent topics of the Connecticut User Group have included software developments for the PC, functions and applications of EDLIN and DEBUG, and professional product aids. Annual subscriptions to the group's *CPC Newsletter* are $5. Contact Dave Foulger, 69 River St., New Canaan, CT 06840.

D.C.

The Washington, D.C. Users' Group plans to have a booth at the PC+1 convention hosted by PERSONNA in Atlantic City. The club counts 400 members and is interested in trading newsletters and software with other groups. Contact Ted Landberg, 13157 Beauwick Ct., Silver Springs, MD (202) 275-2102.

Idaho

The Idaho PC Users' Group holds meetings on the 15th of each month. Contact Bruce Burns, 687 S. Capital Blvd., Boise, ID 83702 (208) 344-5545.

Indiana

The Indianapolis IBM PC Users' Group meets on the fourth Monday of each month. Dues are $15 and entitle members to use the group's software library and receive the newsletter. Contact David Reed, 6704 Hoover Rd., Indianapolis, IN 46260 (317) 259-7892.

Kansas

The Topeka Library User Group meets on the third Thursday of each month. Meetings are held at the Topeka Public Library, 1515 W. 10th St., Topeka, KS 66604 (913) 233-2040. Contact Becky Hinton.

Maryland

Lutherville's user group is looking for members and speakers. The group, numbering 50, meets the first Tuesday of each month at the Lutherville ComputerLand and publishes *I/O News*. Contact Maury Weinstein or Bob Roswell, 1516 York Rd., Lutherville, MD 21093 (301) 337-5555.



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Club News

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The IBM User Group, one of approximately 18 subgroups in the Boston Computer Society, meets every second Thursday. Annual dues of $20 entitle members to attend any subgroup meetings. Contact Michael Rohrbach, P.O. Box 307, Wellesley Hills, MA 02181 (617) 235-8830.

Minnesota
A Minneapolis-area user club meets on the second Tuesday of each month. Annual dues are $10. Contact Peter Le Neau, 100 N. 6th St., #800 East, Minneapolis, MN 55403.

Tennessee
The P.C.L.U.B. user group in Tennessee has started a newsletter. Approximately 50 members meet every second Monday at the Knoxville ComputerLand. Contact Ross Burrus at Science Applications, Inc., Plaza Tower #801, Oak Ridge, TN 37830.

Texas
The Dallas-Fort Worth Users' Club invites visitors to attend meetings the third Saturday of each month. The club has 30 members. Annual membership dues are $30. Contact Samuel P. Cook, 309 Lincolnshire, Irving, TX 75061 (214) 253-6979.

Utah
The Utah chapter of Autumn Revolution has formally organized and elected officers. Meetings are held on the last Wednesday of each month. Contact Debbie Williamson at ComputerLand, 161 E. 200 South, Salt Lake City, UT 84111 (801) 364-4416.

Virginia
The Central Virginia Users' Group newsletter, *The Central Virginia Communicator*, features product announcements and software reviews. The group is interested in exchanging copies of its newsletter and library software with other user groups. A $20 annual fee entitles members to the group's newsletter, software exchanges, and occasional discounts on products. Meetings are on the fourth Tuesday of each month at the Richmond Public Library. Contact Bob Dust, P.O. Box 24685, Richmond, VA 23224 (804) 744-2387.

Canada
PC has received word of a new user group in Canada. For more information, send a SASE to A.R. Nolf, 620 Auburn Crescent, Burlington, Ontario L7L 5B2 Canada.

International
Visi-Group, the independent user group specializing in applications for *Visi-Calc*-type programs, has changed the name of its bimonthly newsletter from *Spreadsheet* to *Inter-Calc*. *Inter-Calc* provides a place to put programming ideas into practice. It features "Visi-Tips," which includes user questions, program formulas, and applications. Visi-Group, whose membership comes primarily from the business community, has branches in New Zealand, Australia, Sweden, Belgium, France, Spain, Israel, Canada, Venezuela, Mexico, and England. Annual membership is $25. Contact Visi-Group, P.O. Box 254, Scarsdale, NY 10583.

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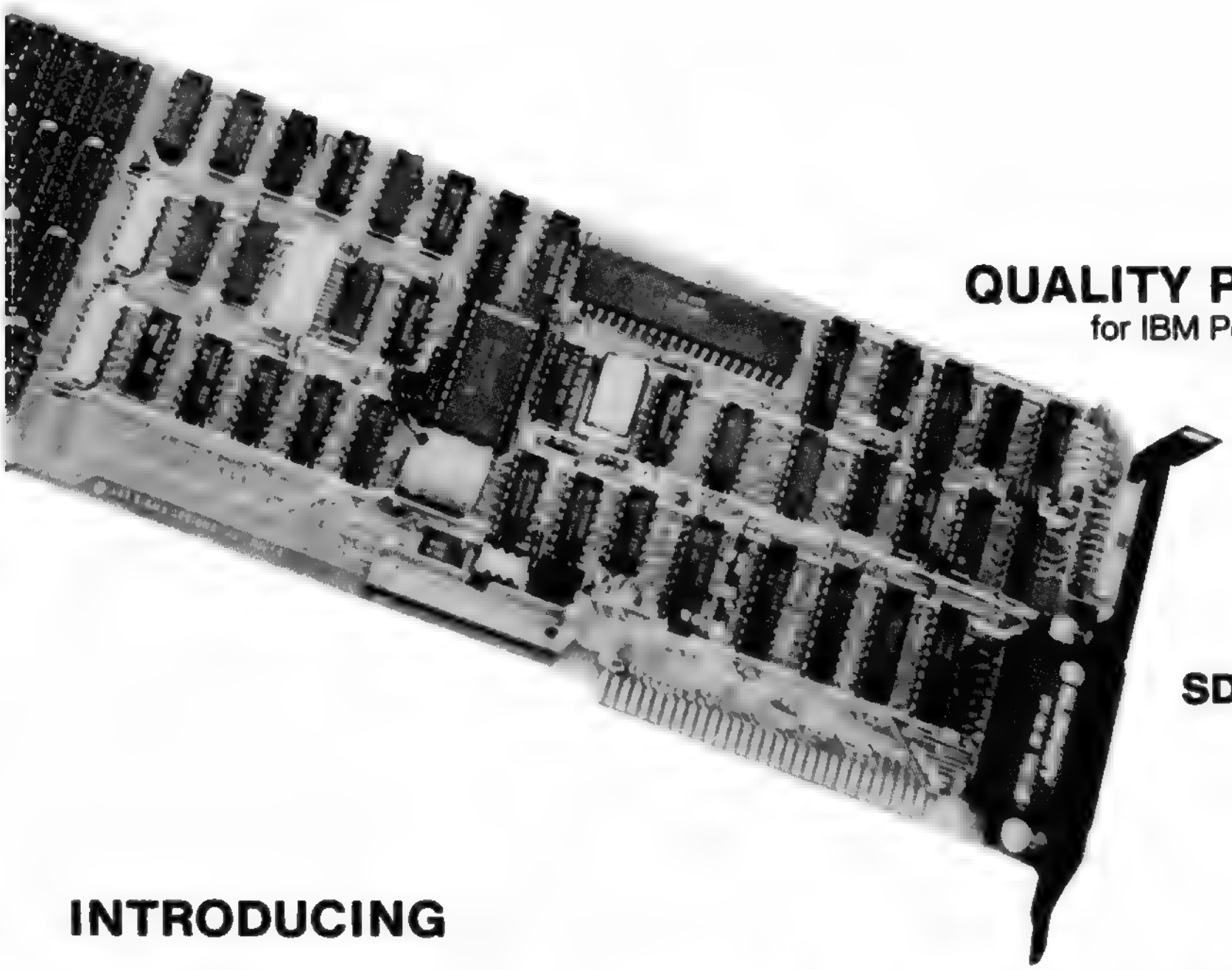
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Communications Briefs

Tips on buying a terminal software package for your IBM PC.

Terminal Software Characteristics

If you intend to use your PC for data communications, a terminal software package turns your PC into a terminal capable of exchanging information with other systems through the serial port. Some of the features of these software packages are useful and some are essential.

Following are essential characteristics:

Parameter settings: You should be able to set the speed, word length, and parity from the program.

Received data capture: You should be able to capture the data coming into the serial port in a RAM buffer. The buffer should either have some indication of how full it is or provide an overflow warning, and it should be easily opened and closed.

File transmission: You should be able to use your program to transmit data files.

Throttling: This feature is very important and probably the most frequently omitted, so it deserves some explanation. Many information utilities and data systems simply cannot accept a continuous stream of characters at full speed. Throttling puts a slight delay between characters. Each character goes out at 300 or 1200 baud, but the total throughput is less. You can usually set the amount of the delay according to conditions at the time. When I transmit files to The Source over Telenet, I find I need a 1/10-second delay between characters. If you transmit files to information utilities or message systems, you should have a throttling capability in any software you buy.

Printer control: Printing data as you receive it is a feature you may want. This capability is often limited by the speed of the printer available.

Those are the things you should have. Following are the nonessential features:

Macros: A macro file contains short messages you frequently use. These may include sign-on codes or various command sequences. A macro can be sent with one or two keystrokes.

Smartmodem interface: The program should provide prestored commands such as automatic dialing to use with a smartmodem.

On-line DOS commands: These commands allow you to read the directory and erase files without returning to DOS.

Line prompt transmission: During the transmission of a file, this feature follows the prompts of the receiving system and prevents overrun.

Protocol file transfer: This capability guarantees nearly 100 percent accuracy in the transfer of a file. The same program must be used by both ends of the transfer.

Paging to and from disk: Good programs are not limited by the size of the RAM buffer for file capture or transmission. They page the data to and from the disk and can transfer complete data files as large as a full disk.

Printer buffer: This buffer allows a slow printer to catch up with incoming data by storing the data and then sending it to the printer at a slower rate.

Character translation: Some systems send characters you don't want on file. A translation table connects incoming characters and has many other specialized uses.

Screen formatting: This provides ways for you to deal with strange combinations of line feeds and extra-long lines.

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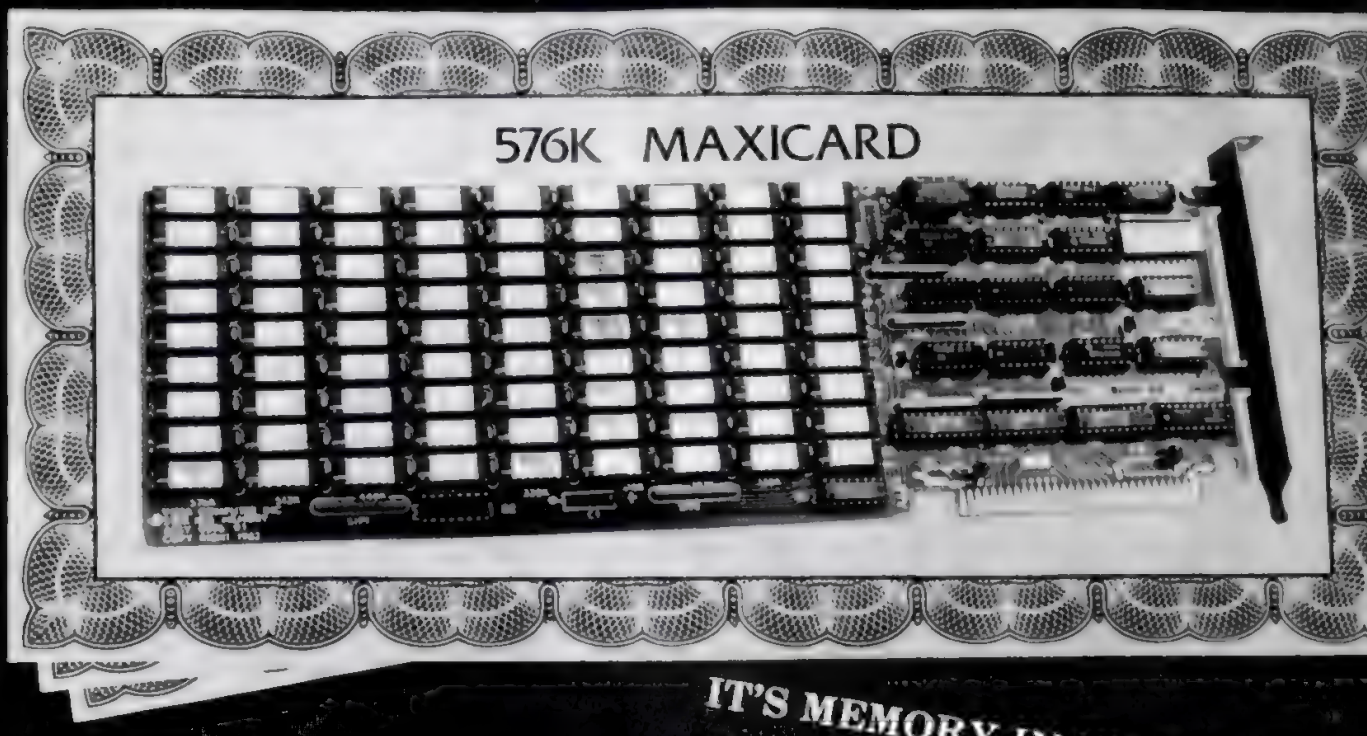
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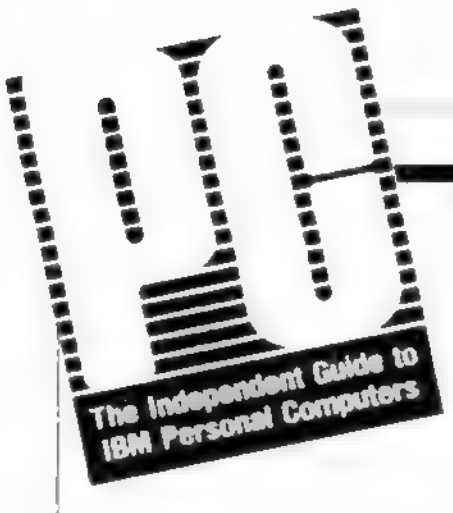
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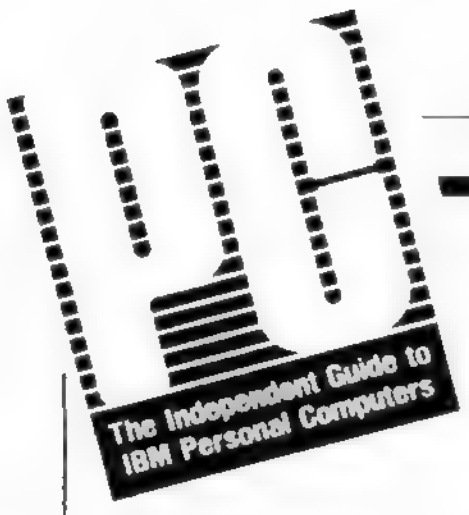
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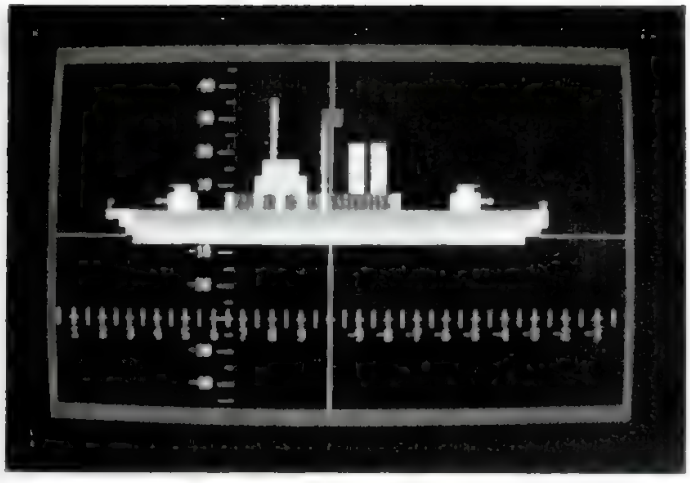
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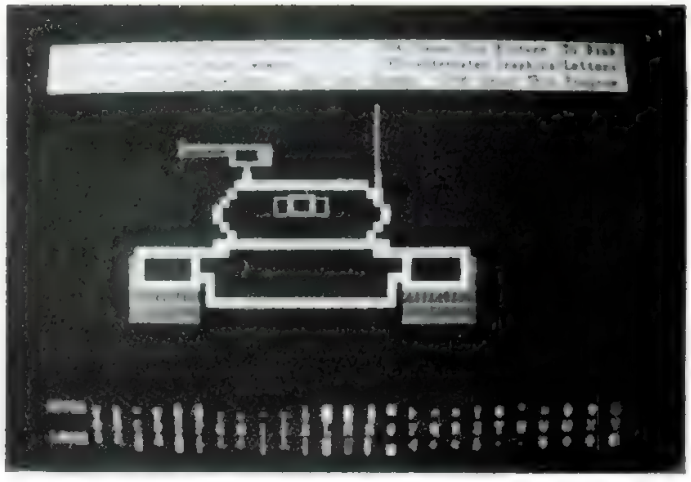
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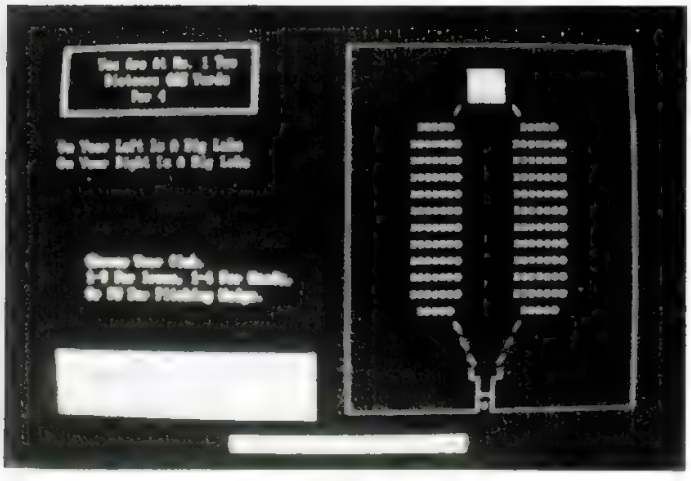
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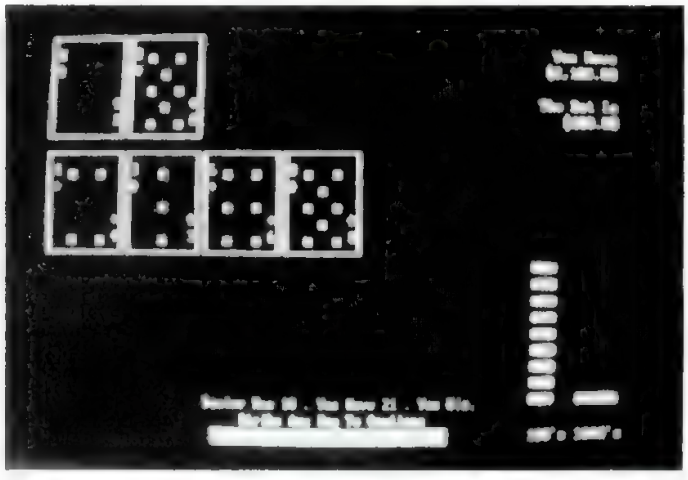
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The Keys To The Kingdom

Part Five

The personal computer traces its roots back to the Altair computer, first manufactured in January 1975 by MITS, Inc., a small company that came from the desert sands of Albuquerque, New Mexico. For the next 2½ years, MITS, so dominated this new-found market that the company literally defined personal computing. David Bunnell and Eddie Currie were both uniquely involved in the beginning of personal computing as MITS vice presidents. Together in this exclusive PC series they tell the story of The Age of Altair.

One hot, dusty day in in the summer of 1976 a small man with gold-rimmed glasses and a pinstriped suit arrived at MITS' Albuquerque headquarters. He said he was a representative of a West Coast hardware company called Pertec Computer Corporation and that he was interested in the Altair. A tour of the facility was given to this quiet, unimposing guest, and then he smiled and went on his way. No one could have imagined the full ramifications of this seemingly unimportant event.

Manufacturers or Packagers?

Before we continue with the story of this mysterious visitor, it is important to understand the peculiar workings of the industry that he represents. The manufacturers of today's micros often purchase as subassemblies many of the microcomputers they produce. Keyboards, monitors, floppy drives, Winchester drives, and switching power supplies can all be purchased from a wide variety of vendors, leaving the micro manufacturer with the task of packaging this assortment in a manner that best suits the perceived market. Even software such as operating systems, applications packages, languages, and development tools is available as subassemblies for manufacturers to package with their hardware.

The IBM Personal Computer employs almost all nonproprietary hardware and software. The disk operating system, IBM PC-DOS, was in fact developed by Tim Patterson of Seattle Computer Products in Bellevue, which produces a line of S100 8086 products. Microsoft acquired the rights to this excellent operating system and undertook an extensive development effort to provide the various features required for the IBM PC.

It is interesting to note that virtually all of the Z-80 machines and many of the IBM PCs continue to run 8080 software, much of which has its roots in the early days of



Illustration: Stuart Bradford

Altair's history. Clearly, MITS' President Ed Roberts' insight into the potential of the microcomputer was visionary and has never been equaled. Everything since has been a variation on his theme.

The Multiuser Boondoggle

It is a curious perversion of this industry that each succeeding generation of hardware since the Altair has reached backwards to the previous hardware generation to find software. Although the race is on to create software for the newer machines, the software of the near future is likely to be little more than recast 8080 software translated into the 8088/8086 environment. Visions of huge quantities of software to rival and replace the offerings of the 8-bit world are pipe dreams meant more to attract the attention of venture capital than anything else. But who could have imagined that softcards would play the role they have in permitting newer generation machines to run what is essentially 8080 software?

When the Z-80 first became available, it offered, among other things, a greatly expanded set of instructions, a subset of which was the full complement of 8080 instructions. It was difficult to anticipate that this chip would be put into widespread use for reasons far more compelling than its more powerful instruction set.

The hardware packagers/manufacturers quickly realized that more important than the expanded instruction set was the fact that the Z-80 required only a single power supply. What's more, it could operate at nearly twice the effective speed of the 8080 and greatly facilitate refresh of dynamic memory by eliminating the critical timing factors that plagued the early dynamic boards used with 8080s.

The doubling of processor speed caused many an unsophisticated observer to assume that the speed of the microcomputer system was directly proportional to the speed of the microprocessor. "Double the microprocessor speed and you double the microcomputer speed" was the widespread belief. This misconception opened the door to yet another chapter of misadventure, which might well be titled the "multiuser boondoggle."

In the early stages of microprocessor development, a primary consideration was that a powerful yet inexpensive processor could be liberally employed in computer designs. This vision held that one microprocessor might be assigned to handle all keyboard activity, another the display, and still another the communications. The technical whiz kids concluded that the slowness of the peripherals would allow plenty of spare microprocessor time to perform other tasks. They went on to speculate that multiuser systems could be supported so that several users might utilize a solitary microprocessor chip.

Failing to recognize the folly of their plan, they rushed off to design a full-blown multiuser, multitasking system. No one worried about such subtleties as protecting individual files, or the problem of several users introducing changes in the same file without the knowledge of the other users. The complication of several people attempting intensive file access had never been anticipated.

The result, of course, proved to be a large number of very unhappy users who discovered, to their horror, that the system speed had slowed to that of a snail. Often files vanished completely, or even worse, were discovered at some future date to have undergone covert modification in an indeterminate fashion. Equally distressing was the fact that dealers took this technological development as an opportunity to compete openly in the minicomputer arena.

The Pinstriped Invasion

But let us return to the small man in the gold-rimmed glasses and pinstriped suit who darkened MITS' doorway. Although he wasn't the first to visit and discuss the possibility of acquiring MITS, he turned out to be the most devastating.

Due to the phenomenal growth of the microcomputer industry, a number of major corporations had sent forth so-called acquisition teams to investigate potential candidates. Most of the teams that came to MITS, however, were never heard from again. Perhaps they were repelled by the hobbyist nature of the personal computing world. The generic classification of hobbyist cast a pall upon the legitimacy of the industry and this stigma was to remain for many years. It was not to be fully removed until the advent of the IBM Personal Computer in September of 1981. Still the teams of corporate magi came. Even if these hobbyists couldn't be taken seriously as a financial risk, it was still interesting to see what they were up to. Thus it was not unusual to see the small man in the gold-rimmed glasses and pinstriped suit getting the "visiting fireman" tour of the facility. This particular visit was not unlike previous visits by others, with one exception: The visitor from Pertec seemed most particularly close-mouthed and offered little about the specifics of his interest. After a brief visit, he returned to Los Angeles, leaving behind a somewhat puzzled but nonetheless excited president.

Soon thereafter there was a series of visits by the pinstriped suits from Pertec. A rumor circulated at MITS that if a Pertec employee supplied a dark suit, the management would provide the pinstripes. The boys from the West Coast were never seen without their uniforms, and they came further armed with notebooks, clipboards, and probing questions. Their charter was to gather substantiating evidence to support the position of the president of Pertec: MITS/Altair might just be worth the risk.

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Some of the pinstripes were forced to stay a long time in Albuquerque to collect all the evidence they needed. One likeable chap was told by MITS employees that a formal request would be made that he be permanently assigned to MITS. Unfortunately, this homesick investigator felt he had been marooned in a desert outpost and he would respond to these offers by removing the worn envelope from his inside pocket, which carried his written assignment from Pertec. Emphatically, he would read aloud the passage stating that his was only a "temporary assignment." Finally, he confessed that the real problem was his dog, who had stated unequivocably that he refused to relocate.

One morning Dr. Currie was summoned to the office of MITS' president, H. E. Roberts. As the door closed behind him, he sat down in front of the president's rosewood desk and waited patiently. After a mysterious pause, Roberts said, "Plan on staying at my house for the weekend. We have to review our marketing plan on Monday with the Pertec boys."

"Marketing plan? What marketing plan?" Dr. Currie's mind raced over the events of recent months, frantically trying to remember any document within the hallowed halls of MITS that could even loosely be described as a "marketing plan." His screen remained blank.

Nevertheless, Pertec demanded a 5-year plan for all its corporate activities, and that weekend was devoted to the development of a business forecast for MITS' projected corporate life. The basic rationale was that sales would double each year. This was based in part upon the fact that MITS' sales of microcomputers had been $1.5 million the first year, $3 million the second year, and that sales were currently running at a $6 million rate. Once the annual revenue had been determined, it was relatively easy to detail the product mix since the majority of systems sold was assumed to be small-business configurations such as terminals, printers, dual floppy drives, and mainframes with 64K of RAM.

This information was fed into a hastily written BASIC program and the report was prepared on an Altair in Roberts' home. Monday morning copies of the 5-year projection were distributed to the "boys." After a cursory review, the pinstripes returned to Pertec with "The Plan."

As Dr. Currie drove home that evening, exhausted from his adventure in marketing, he had no way of knowing that this ad hoc forecast would be engraved in stone upon its arrival in Los Angeles.

Curiously enough, their audacious prediction of doubling sales each year was never again questioned. Rather, it served as the rocky coast upon which the Good Ship Lollipop (Pertec) was to run aground. This solitary document was to cause the demise of many a marketing manager and more than a few general managers at Pertec in the months to come.

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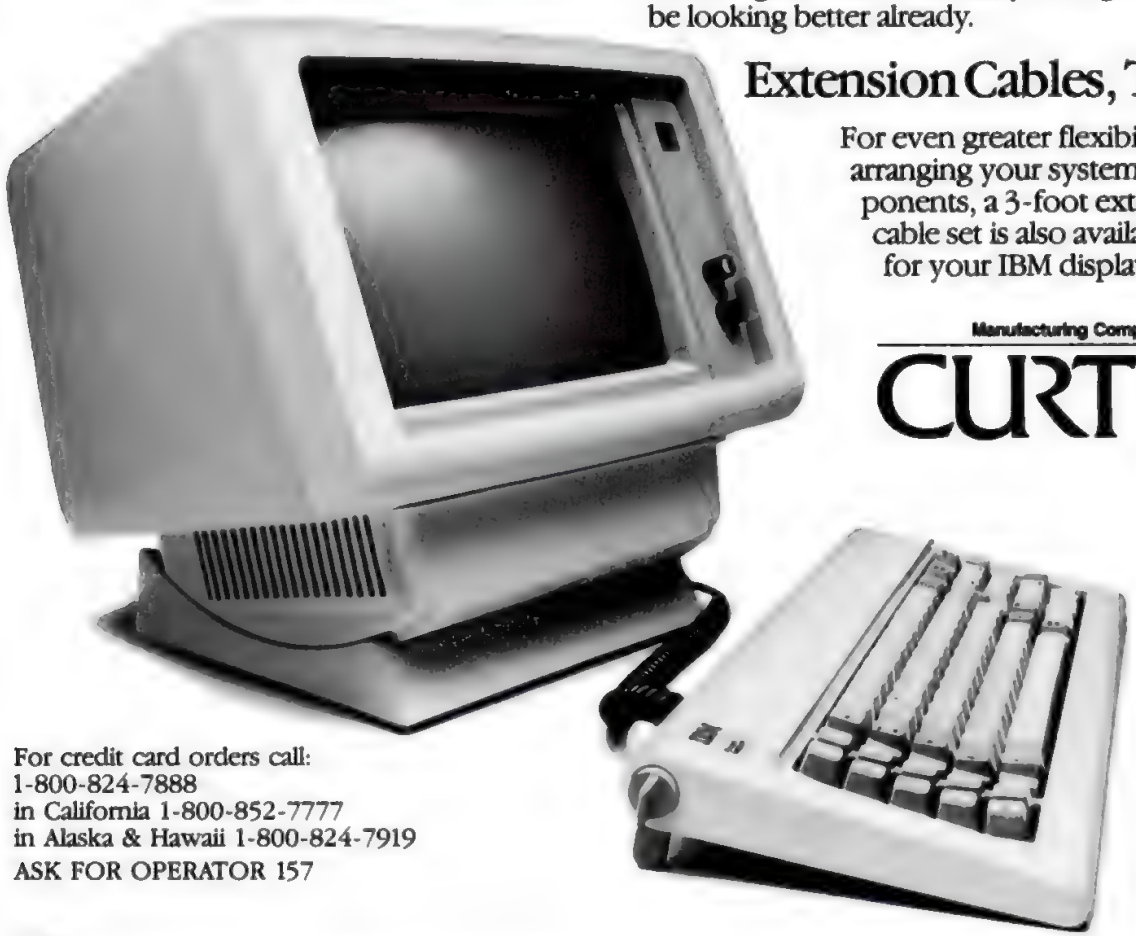
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attention was turned to the subject of MITS BASIC and the Microsoft/MITS exclusive contract. MITS had been anxious to offer a language or languages for the Altair microcomputer and had searched far and wide for suitable products. Representatives of Intel had speculated that such implementations were impractical since the 8080 was not sufficiently powerful to run a language such as BASIC.

Undaunted, Roberts pursued every lead. One candidate was proposed by a small company in Seattle called Traf-O-Data. Traf-O-Data would take traffic-recorded tapes, run them through an 8080-based computer, and produce a graph that summarized traffic activity during the period covered by the tape. A letter bearing the heading Traf-O-Data and dated January 2, 1975 arrived at MITS soon thereafter. The letter stated in part: "We have available a BASIC language interpreter that runs on MCS-8080 series computers. We are interested in selling copies of this software to hobbyists through you. It could be supplied on cassettes or floppy disks to users of your Altair series microcomputers. We should anticipate charging you $.50 a copy, which you could then sell for somewhere between $75 and $100. If you are interested, please contact us."

The last sentence prompted Roberts to reach for his phone. The call soon revealed that the number given in the letter was in fact a Seattle boarding house. Unfortunately, no one was available at that number to discuss a BASIC language interpreter. Roberts' search continued.

Microsoft was founded as a New Mexico corporation in 1975. Later it was formed as a joint partnership between Paul Allen and Bill Gates. Both Paul and Bill had first encountered computers while attending Lakeside High School in Seattle where they developed a microprocessor-based traffic data acquisition system. Ric Weiland, who was later to write the 6800 version of Microsoft BASIC as well as Microsoft COBOL, was also a classmate of Bill's and Paul's.

Paul was to handle all of the negotiations with MITS for an exclusive license to Microsoft BASIC. The distinction between a sale and an exclusive license for software is an interesting one and in this case was to prove a crucial issue. An exclusive license in this instance was for the most part almost indistinguishable from Microsoft having sold BASIC to MITS. However, not all of the right, title, and interest passed on to MITS.

MITS was to use its "best efforts" to promote the sale of BASIC licenses to third parties such as manufacturers. This meant that a manufacturer or end user could never legitimately claim ownership to a given software package. What was actually conveyed to the buyer was certain limited rights to use the product or, in the case of third parties (OEMs), the right to convey sublicenses to end users.

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LabVU Data Gr..... $29.95
Addr & Labels pgm .. $29.95
IDS Prism Printer Software & Cable..... Soon
Above graphics programs need IBM Color Graphics with dot matrix printer
Stocks/Graphics $49.95
THE ANSWER DBMS.. $250.
TRANSFILE Pgm (incl. 2 disks & cable)
TRS-80 to PC..... $199.95
Applesoft/Integer .. $199.95
Statistics Pgm* $225.00
*Doc. avail $20 (Purch cred)

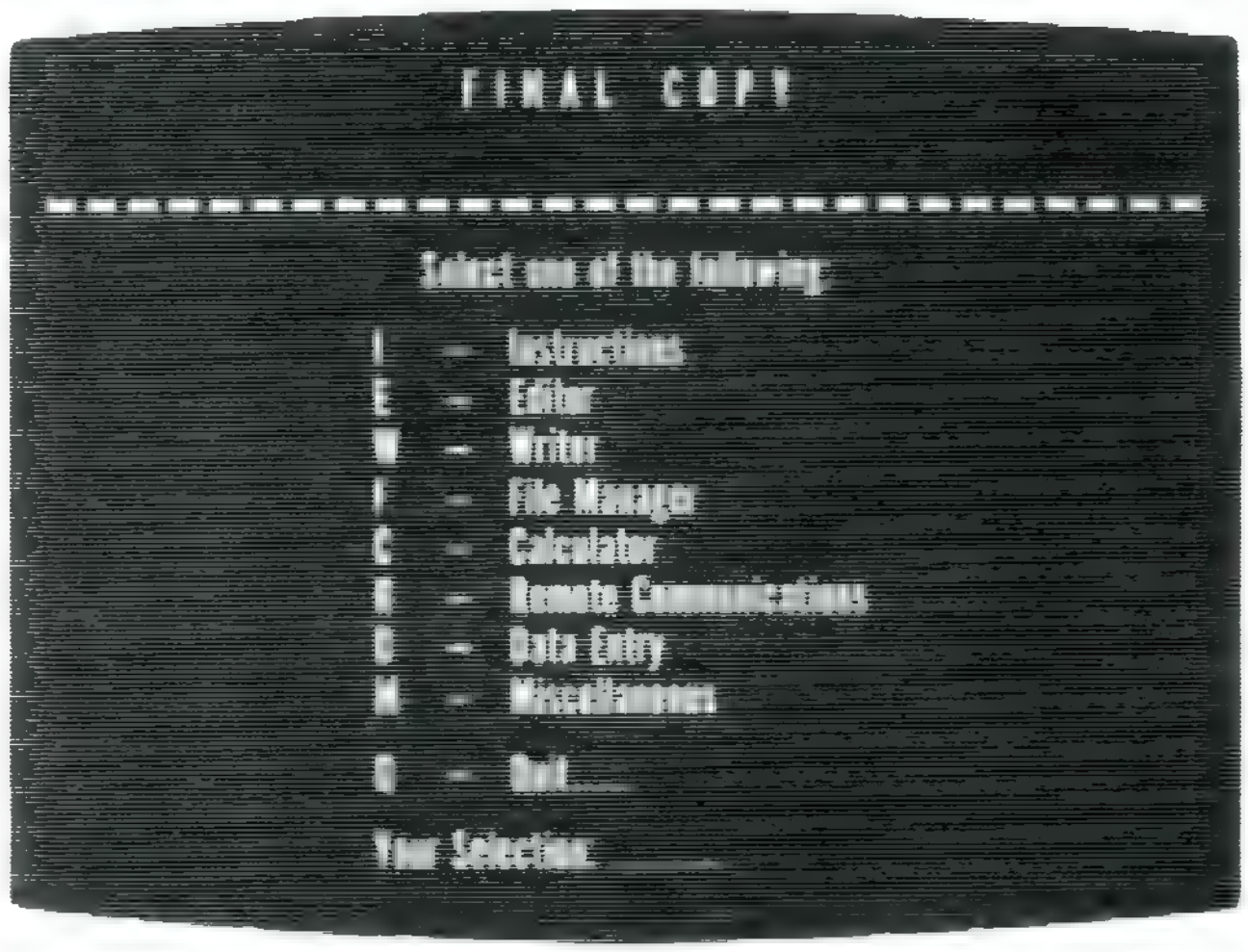
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right to deny sales of licenses to those who might be competitors. The obvious catch here was that anyone interested in an OEM license to BASIC for microcomputers could be considered a competitor. On the other hand, the royalties that accrued to Microsoft during the first few months amounted to a pittance. One of the reasons for this void soon became evident. Reportedly, hobbyists were attending computer club meetings and openly and defiantly copying BASIC for distribution to one and all. This practice prompted Bill Gates to write an open letter to hobbyists complaining about the flagrant copying of BASIC. Inadvertently, it was implied that all computer hobbyists were BASICally thieves.

The outcry was immediate and outraged as the hobbyists attempted to defend their liberation of BASIC software. A strangely convoluted logic for copying was promulgated: 1) BASIC was felt to be in the public domain (How could someone legitimately sell and distribute a proprietary version of what some believed to be essentially a Dartmouth BASIC?); 2) Hobbyists considered themselves altruists, not thieves, and in most cases they could not afford to pay for BASIC after investing their entire discretionary fund in hardware; and 3) Without BASIC software their systems were, for the most part, inert. Thus it followed that that which is not properly yours to sell, and which is prohibitively expensive to the average user, and which is required to render one's system functional, is clearly up for grabs.

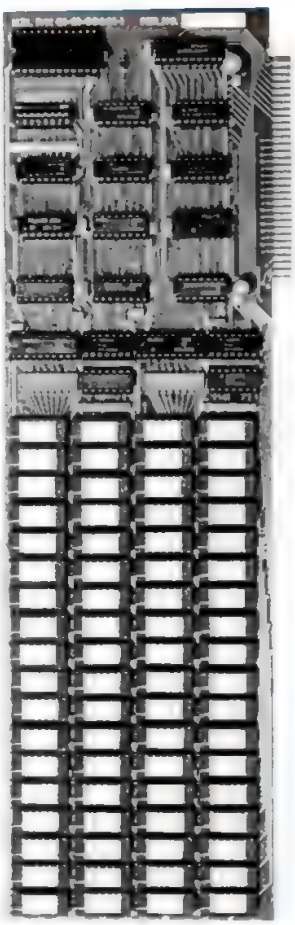
This hue and cry from the hobbyists resulted in a second open letter from Microsoft designed to clarify this issue but nonetheless to serve as notice to the hobbyist community at large that open and wholesale piracy of software was nothing less than an abomination.

What the hobbyist had failed to recognize was that software development was and is an extremely costly and time-consuming effort and that quality software could not evolve in a marketplace in which the customers felt no particular obligation to invest more than the cost of a diskette. There can be little doubt that Microsoft at that point began to look longingly in the direction of OEM customers. Not only were they quite willing to pay the price required to acquire quality software, but they also had a long-term, vested interest in Microsoft's prosperity. */PC*

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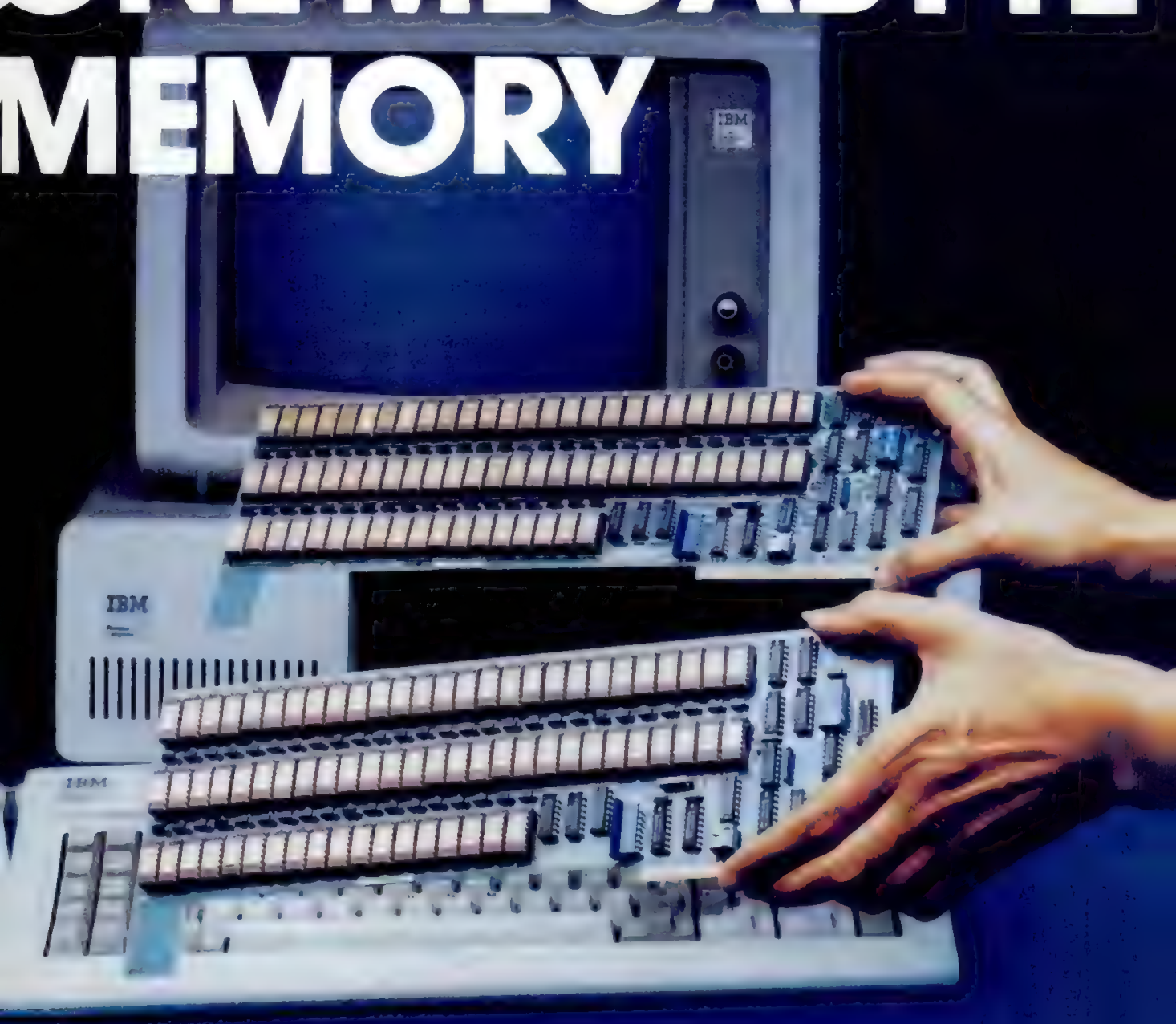
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2036 Los Altos Ave., Los Altos, CA 94022 (415) 941-5500

New On The Market

HARDWARE

Wiring Boards

Three drilled universal wiring boards—Models 4613, 4613-1, and 4613-2. The boards allow for rapid design and prototyping of interface circuits, memory expansion boards, I/O adapters, or other special functions. They are form- and plug-compatible with IBM cards and can be installed in any of the PC's five expansion slots.

The boards were designed for breadboarding, prototyping, and low-volume production. Model 4613 has three-hole solder pads interspersed between heavy power and ground buses. It was designed for solder-wire interconnections and can hold up to 48 14-pin DIPs, 41 16-pin DIPs, or a mixture of devices with various pin spacing.

Model 4613-2, for wrapped wiring, has a full ground plane on one side, a power plane on the other, and three alternate power buses. It mounts 60 14-pin DIPs or 55 16-pin DIPs. The board can also hold three rows of 0.6-inch-wide DIPs, two rows of 0.3-inch-wide DIPs, and one row of 0.3-inch-wide DIPs.

Both boards have drilled, plated-through holes (0.043-inch diameter) spaced on 0.1-inch centers. In addition to the DIP mounting area, the boards include a 3.5-inch-square area with individual padded, plated-through holes for mounting discrete components or hardware.

Model 4613-1 is bare except for heavy power and ground buses around the perimeter. The 0.043-inch-diameter drilled holes on 0.1-inch centers permit users to mount up to 84 16-pin DIPs on close centers or 69 16-pin DIPs spaced 0.1 inch apart. All models can be shortened without disturbing continuity of power and ground buses. A special mounting area on each board accommodates connectors for I/O wiring. A double row of holes accept 9-, 15-, 25-, or 37-pin D subminiature connectors. Hole numbers etched in the copper on the boards' peripheries permit easier identification of components. Each board comes with layout planning sheets, instructions, a card guide, and a universal I/O connector mounting bracket.
List Price: Models 4613 and 4613-2 $59; 4613-1 $37.
Vector Electronic Co. Inc.
12460 Gladstone Ave.
Sylmar, CA 91342
(213) 365-9661
TWX: 910-496-1539

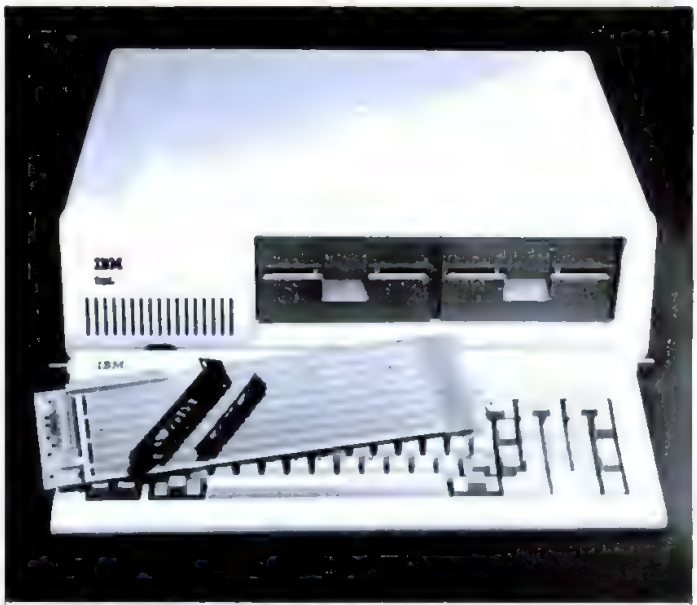
RAM Card

A RAM+card that combines 64K, 128K, 192K, or 256K of memory and an RS-232 serial port on a single card. It leaves an open slot in the PC for additional add-ons.

The Flash Disk software allows the memory to be utilized as a disk. Information is found by electronically simulating a disk drive that is 10 to 50 times faster than a mechanical disk. Copying frequently used programs and data to the Flash Disk makes the programs instantly accessible, thereby ending disk access delays. The Flash Disk is also applicable for temporary intermediate files. The Flash Disk is free with the RAM+ card. Each card comes with a 1-year guarantee from the manufacturer.
Seattle Computer
1114 Industry Dr.
Seattle, WA 98188
(800) 426-8936, (206) 575-1830

Light Pen

A light pen for use with all software statements in the IBM BASIC manual. The pen, which can be programmed in BASIC, Pascal, and machine code, plugs directly into the color/graphics adapter. With the software provided, users can create graphics, choose from menus, evaluate interest rates, make sound, paint, edit characters on the screen, and read and display the direction the light pen is pointing. The pen operates with almost any black and white, green, or color monitor including RGB monitors such as Amdek's Color II, NEC, and Electrohome. The pen does not work with the IBM monochrome monitor because the monitor's P-39 phosphor does not emit light in the right spectrum for the pen to see.
List Price: Light pen $150; software disks $10 each.
Symtec
15933 West 8 Mile
Detroit, MI 48235
(313) 272-2950



Phototyping and expansion board model 4613 for IBM personal computer from Vector Electronic.

Matrix Printer

The Microprism features a special printing technique that gives users bold, high-quality characters at 75 cps, or high-speed printouts at 110 cps. IDS's DotPlot graphics are standard on every unit. Many of the features of the company's Prism printer line are standard on the Microprism as well. Features include proportional spacing; 10, 12, and 16.8 cpi; 9-wire printhead; pin and friction feed; serial and parallel interfaces.
List Price: $799.
Integral Data Systems
Milford, NH 03055
(603) 673-9100

New on the Market does not review products, but reports information provided by the manufacturer. If you have a product you would like to have included in this section, send a brief description that includes applications, price, and system requirements to New on the Market, PC 1528 Irving St., San Francisco, CA 94122. Photographs and illustrations are run on a space-available basis.

The Independent Guide to IBM Personal Computers

New On The Market

Memory Board

A 256K RAM expansion memory board that features full parity checking to detect errors and bank selection in blocks of 64K. Blocks can be noncontiguous for software compatibility.
List Price: $529.
Pure Data Ltd.
950 Denison St. #17
Markham, Ontario
L3R 3K5 Canada
(416) 475-2424

Digitizer

A fourth-dimension stylus tilt for use with graphics digitizer tablets. The stylus allows for direct-control rotation of 2- or 3-dimensional images. By using the stylus tilt, users can transmit information concurrently with X, Y, and Z information. GTCO's technology permits electronic sensing of the magnitude and direction of stylus tilt with respect to the tablet's surface. This advance transforms the stylus into an unrestrained joystick/digitizer. The tilt-sensing is nonmechanical and is thus independent of acceleration, vibration, gravity, or wear. The 4-dimensional digitizer can be purchased as an option on any size Digi Pad from GTCO.
List Price: $200.
GTCO Corporation
1005 First St.
Rockville, MD 20850
(301) 279-9550
Telex: 898471

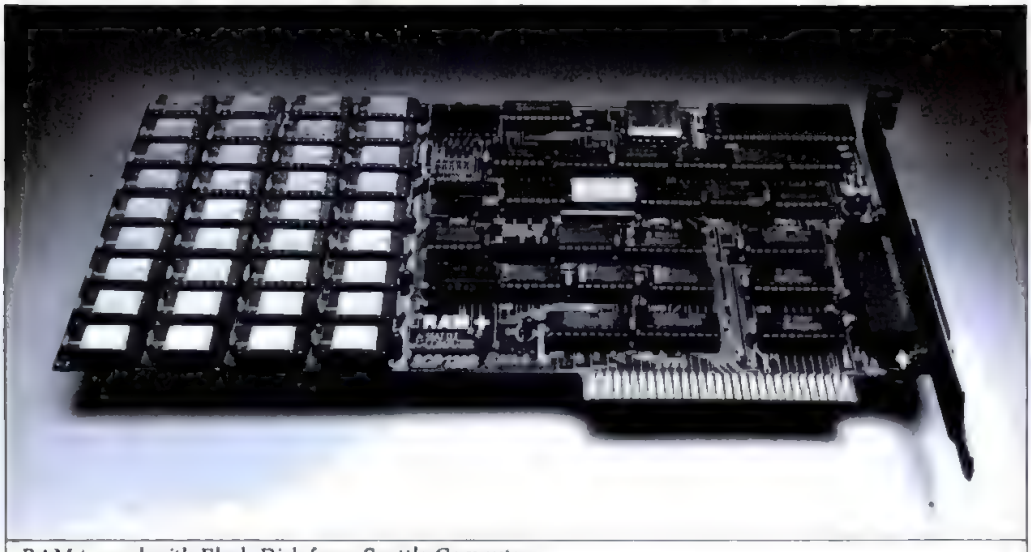
Automatic Disk Copier

A format module for IBM PC-compatible disks to be used on its two desk-top model disk copiers. The module enables users to automatically mass produce software programs written for the PC. The Format Module serves to expand the library of applications programs produced by third-party software developers for the PC and increases the number of distribution outlets marketing applications programs. Models 5208 and 5248 desk-top floppy disk copiers are designed for duplicating and verifying single- and double-sided 5¼-inch, 48 tpi disks. The fully automatic units provide operator-selectable copies in quantities of one to 999. The module is available on disk from the manufacturer.
List Price: $450.
Media Systems Technology
17991 Fitch Ave.
Irvine, CA 92714
(714) 957-0240

Decoder Modem

A Touch Tone decoder modem for decoding standard telephone touch tones and converting them to ASCII equivalents. The product has a provision for a Bell 103 (300 baud) or Bell 202 (1200 baud) data output response. An audio port for voice response is also available as an option. The Touch Tone decoding host modem connects the direct-dial telephone network with a host computer. It may be used in conjunction with any host computer capable of asynchronous communications via an RS-232 port. The modem also incorporates auto-answer circuitry. When the modem is called, it goes off-hook and awaits suitable Touch Tone input for 2 minutes. If no input is received, the modem automatically resets to on-hook to await the next call. When one of the 16 valid Touch Tone pairs is received, it is converted to the ASCII equivalent and is sent in a serial stream to the host. The outbound responding data from the computer is used to modulate a frequency shift keyer, permitting the data to be transmitted over the telephone network to the calling terminal.

Communication with the host is at 300, 600, or 1200 baud, depending on the model selected, via a standard DB-25 connector. Since the same baud rate is used for incoming and outgoing data, no special split baud rate software is required. In voice response applications the digital input of the Touch Tone modem can be replaced with an audio input circuit.
List Price: $500.
Microperipheral Corporation
Koll Business Center
2643 151st Pl. NE
Redmond, WA 98052
(206) 881-7544



RAM+ card with Flash Disk from Seattle Computer.

RGB Monitor

A high-resolution RGB color monitor designed to give 16-color, 80-character display. The monitor uses an NEC .31mm dot pitch tube to provide up to 690 dots of horizontal resolution. The nonglare, black matrix screen was designed for professional applications. Each unit is supplied with a connector cable to plug directly into the IBM color adapter card.
List Price: $795.
Princeton Graphic Systems
195 Nassau St.
Princeton, NJ 08540
(609) 683-1660
Telex: 6857009

Monitors

The USI Pi line of high-resolution monitors for small-business and personal computers. The monitors feature ergonomically designed phosphor and nonglare screens. The monitors are available in 9- and 12-inch screen sizes and feature low-fatigue, green phosphors except for the Pi-4, which has an amber phosphor. All three monitors have 1,000-lines-at-center resolution with 20 MHz bandwidth, corner to corner legibility, and lowercase descenders.

They are supplied in computer-coordinated enclosures that feature front panel display brightness/contrast controls, power switch, and LED power indicator. The monitors have full 80-character by 24-line text displays. Connection to small-business or personal computers is possible with RCA phone jacks and a standard SO-239 connector.

List Price: Pi-1 $249; Pi-2 $275; Pi-4 $215.

USI Computer Products Division
71 Park Ln.
Brisbane, CA 94005
(415) 468-4900

Multifunction Module

A multifunction module that is available in four separate memory configurations, occupying only one expansion slot on the PC. Features include standard 192K or 256K bytes of memory. Either version can be expanded by an additional 256K. Two RS-232C serial asynchronous channels are also provided. The channels are compatible with the IBM COM1: and COM2: protocol.

The module is available from participating Computer-Land stores and other selected dealers. A 1-year warranty is included.

List Price: 512K plus 2 Async $1,590; 256K plus 2 Async $895; 192K plus 2 Async $795; 256K upgrade $695.

Intermedia Systems
10601 S. De Anza Blvd.
Cupertino, CA 95014
(408) 996-0900

RAM I/O Cards

Three multifunction RAM I/O cards that provide serial, parallel, and game I/O and allow users to expand system memory to 320K using only one expansion slot. The cards are available with 64K, 128K, 192K, or 256K memory installed. The 64K through 192K boards are user upgradeable to 256K, and expansion kits are available. Users can plug in the memory chips; no soldering is required. All memory is fully parity checked for data errors.

The parallel I/O port is a bidirectional 8-bit port designed to interface to a printer or hard disk controller. The port is software compatible with the IBM parallel printer adapter. It is accessible through a standard 26-pin ribbon cable interface on the circuit board. An optional cable to the rear panel of the PC is available. The parallel port can be disabled or offset to an alternate address by switches to allow multicard use. An optional printer cable is also available.

The asynchronous RS-232C port is also software compatible with the IBM serial interface adapter. The serial port is available through a 25-pin connector on the card's rear mounting bracket, and optional terminal and modem device cables are available. The game port is software compatible with the IBM game paddle adapter and can be made compatible with IBM joysticks through optional interface cables. All three boards come with a 1-year warranty.

List Price: STB-RI/064 $599; STB-RI/0192 $869; STB-RI/0256 $999.

STB Systems, Inc.
P.O. Box 1811
Richardson, TX 75080
(214) 596-6689



Format Module from Media Systems Technology.

Interface

A direct, high-speed coaxial cable attachment for the IBM 3274, 3276, and Integral Type "A" terminal controllers. PC/3274 allows for a 3270 native mode connection into an existing 3270 terminal network without the need for modems, telephone lines, or additional 3705 communications line support. It operates with both channel attached and remote, either BSC or SNA/SDLC linked, 3274 controllers.

This unit is a high-speed, microprocessor-based interface that mounts inside any available slot in the PC. It operates independently from the 8088 microprocessor and provides total protocol compatibility with the IBM 3270 network as a terminal, while allowing full stand-alone processing activities by the PC. The interface is fully buffered, providing on-board storage of two 1,920-character screen pages. It provides complete screen-size compatibility with all 3270 monochrome and color character displays as well as use of the APL character set.

The PC/3274 screen buffers are accessible from high-level language programs that run in the PC itself through simple I/O commands. Screen buffers may be read and modified by the support program, which is written in C language. The interface will be sold through retail PC outlets and direct sales to large-volume end users.

Technological Analysis Corporation
120 W. Wieuca Rd. NE
Atlanta, GA 30042
(404) 256-9647
Telex: 54-9600

New On The Market

SOFTWARE

Financial

Three financial software products. The *CBOOK* is a single-entry bookkeeping system with a chart of accounts to match Federal Income Tax Schedule C (Profit or Loss from Business or Profession). The program develops standard-format Profit and Loss Statements throughout the year and automatically produces a full Schedule C in IRS-approved format.

The *Loancomp* program computes interest and principal balance for monthly, annual, and loan total periods. It also computes payments required to amortize a loan. The program can also make "True Annual Percentage Rate" computation. A separate section analyzes ordinary annuities with monthly, quarterly, semiannual, and annual payments.

Taxplan computes tax liability for 1981 through 1985. Features include Income Averaging and Minimum/Maximum Taxes for any or all years. The program can change figures in 30 seconds and print statements.
Requires: 64K, one disk drive.
List Price: *CBOOK* $199.95; *Loancomp* $97.95; *Taxplan* $249.95, $149.95 to registered users of the company's full Income Tax System.
Contract Services Associates
706 S. Euclid
Anaheim, CA 92802
(714) 635-4055

Accounting

A comprehensive, menu-driven accounting system designed for CPAs and small- to medium-size businesses. The complete program consists of four packages: General Ledger, Accounts Receivable, Accounts Payable, and Payroll. Each package can be used independently or will post directly to the General Ledger. The system handles departments, prints invoices, statements, aged accounts receivable and payable, payroll checks, and W-2 forms. Federal, state, and local taxes can also be accommodated. The program includes comprehensive training manuals and telephone support by the company's staff.
Requires: 64K, two floppy disk drives or hard disk, 132-column printer.
List Price: $365.
Insoft, Inc.
10175 S.W. Barbur Blvd. #202B
Portland, OR 97219
(503) 244-4181
Source: ST1765



USI International Pi monitors.

General Business

New products that incorporate a method of Indexed File Access instead of Record Number Access. *Mail List/Labels* sorts on any field and selects any or all records for labels on a directory. The program can search for and display the exact or most similar records. Multiple label sizes are also supported.

Screen Generator allows users to key in the screen as it is to appear. The screen is then saved in a file for use in a program. Hard copy includes input field locations and size.

Programmer Utilities is a menu-driven program that displays, edits, or lists virtually any file. The Control file can save dates and user names, among other information.

Retail Sales/Inventory provides an invoice-formatted screen for sales input. Customer lookup and credit limit checks are performed with item lookup for description, cost, on-hand quantity, and price. Automatic inventory update and sales analysis reports are included.

Telephone Directory keeps track of names and addresses, home and work telephone numbers, birthdays, and miscellaneous personal notes. Records are printed and/or accessed by a 1-5 character code for screen display.
List Price: *Mail List/Labels* $95; *Screen Generator* $45; *Programmer Utilities* $75; *Retail Sales/Inventory* $195; *Telephone Directory* $25.
Data Consulting Group
877 Bounty Dr. #EE203
Foster City, CA 94404
(415) 349-4001

Real Estate

Real Estate Template is a problem-solving tool designed for business executives, developers, brokers, accountants, attorneys, and real estate analysts. Menu selections appear on every *VisiCalc* screen to prompt users to load new templates on top of the template currently in memory. This overlay technique makes use of unpublished *VisiCalc* capabilities. It results in automatic screen reformatting and presentation of new menu selections.

Included on the two disks are options that generate the following interactive reports: internal rate of return, A.C.R.S. depreciation, straight-line depreciation, declining balance depreciation, sum-of-the-year-digits depreciation, amortization system, mortgage loan analysis, personal financial statement, and income property investment analysis.
Requires: 64K, *VisiCalc*, one disk drive.
List Price: $119.95.
Sofstar, Inc.
13935 U.S. 1, Juno Square
Juno Beach, FL 33408
(305) 627-5511
Source: CL1299

Spreadsheet

An electronic spreadsheet program with help menus, *Fast Figure* offers business calculations such as depreciation, present and net present value, internal rate of return, compound growth, standard deviation, and what-if analysis. The program has a three-dimensional file sharing feature, which allows users to create multiple spreadsheets from one file without data re-entry. *Fast Figure* is available from the manufacturer.
List Price: $150.
Hourglass Systems
P.O. Box 312
Glen Ellyn, IL 60137
(312) 690-1855

PERFIN

THE VERSATILE PERSONAL FINANCIAL PROGRAM.

PERFIN lets you keep track of all your financial information easily. PERFIN doesn't require special knowledge of accounting or computers yet offers a full range of features:

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- Reports and bar-graphs on both screen and printer
- Full editing features
- Simple start-up with the included configuration program

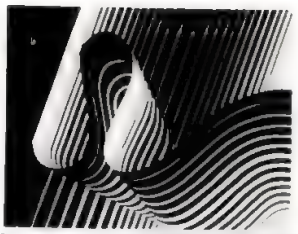
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(301) 668-9011
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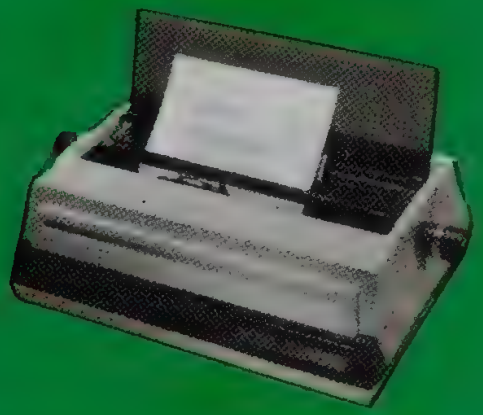
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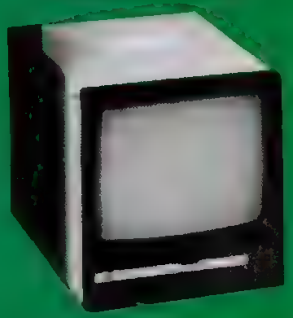


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New On The Market

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A full-screen text editor specifically designed to simplify and speed up editing of programs written in assembly language and structured languages such as Pascal and PL/I.

Vedit can be used in combination with a text processor or as a stand-alone word processor. User aids include automatic screen scrolling and an "undo" key. Another feature allows users to recover from full disk conditions to delete files, or change disks in the middle of an edit session. Automatic indenting is used with structured languages. Ten buffers can hold macro command strings to perform complex multifile editing.
Requires: 64K, one disk drive, DOS or CP/M-86.
List Price: $195; update option $45.
CompuView Products, Inc.
1955 Pauline #200
Ann Arbor, MI 48013
(313) 996-1299

P-Edit is a full-screen program/text editor. Features include a virtual edit buffer, function key implementation, user-definable macros, search and replace, block move, delete, append, and print, dynamic insert, horizontal scrolling, variable tabs, half-tab, duplicate line and field, and a self-instruction package.
List Price: $195.
Satellite Software International
288 West Center
Orem, UT 84057
(801) 224-8554

Subset Compiler

The Ada subset compiler includes many features of Ada needed for microcomputer programming. The Ada subset includes separate compilation and user-defined data types.

The Janus compiler produces code for its host machine using the standard Ada method for separate compilation. Janus can check all references to external definitions. Janus programs are also portable to mainframes.

Object code for the compiler, disassembler, linker, and assembler is provided on disk. Runtime library source code and example programs are included.
Requires: 96K, two disk drives, CP/M-86.
List Price: $400; manual only, $25.
RR Software
P.O. Box 1512
Madison, WI 53701
(608) 244-6436

Text Processor

A friendly and powerful visual text processor featuring copy move, global search and replace, file merge, and margins. Purchase price of *TextPower* includes the user manual.
Requires: 64K, monochrome monitor.
List Price: $50.
Ann Arbor Software Associates
P.O. Box 7345
Ann Arbor, MI 48107
(313) 572-0598

The *SuperWriter* word processing package offers microcomputer users a comprehensive range of text handling functions. The program is a fully integrated text processing system that provides users with the ability to create, edit, and print reports, letters, and other documents without lengthy and repetitive typing.

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Printing and formatting features include underscoring, boldface, sub- and superscripts, variable pitch control, headers and footers, override and spool printing.

The spelling feature combines a proof spelling menu, a special word review, and the ability to edit the dictionary for use with the user's application. Tools for performing form letter generation, mailing list development, and specially formed reports are also provided along with quick file handling. A user manual with complete documentation of the command structure and a glossary are included.
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List Price: $20.
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Other features include user-definable record size, field type, and width for custom reports. Information can be retrieved in ascending and descending order. Indexes are created for each data table on major and minor key fields. The program supports full read, write, and modify data security and includes backup, copy, and recovery capabilities.



Light Pen from Symtec

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List Price: Program and manual $225; manual only, $19.95; Query Language $75.
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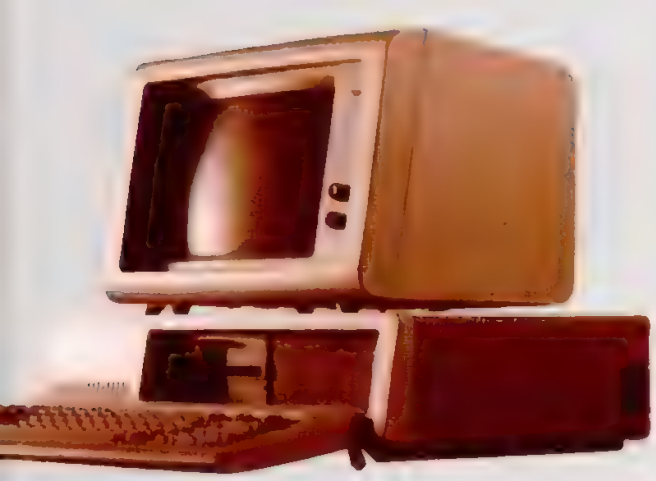
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The program correctly handles backspace, bell, linefeed, and carriage return characters. *ICOMM* was designed to work with a modem or direct cable connection and can work at full speed up to 1200 bps. Higher speeds use XON/XOFF handshaking. Purchase price includes two disks and a 38-page user manual.
Requires: 64K, one disk drive, communications adapter, 80-column monitor.
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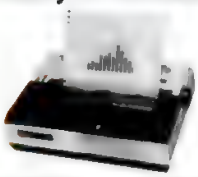
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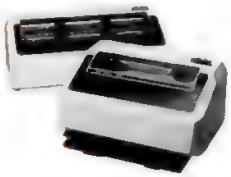
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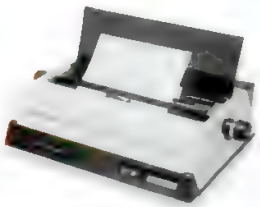
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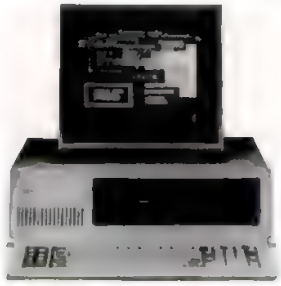
Index To Advertisers

ADVERTISER	LOCATION
Aegis Systems	99
AEON Concepts	58
Aerocomp	78
AHA, Inc.	261
Alphanetics	309
Alpha Software Corp.	156-157
Alta Systems, Inc.	261
Amdek Corporation	10
American Planning Corp.	181
American Small Business Computers	86
American Software Club	213
And/Or Press, Inc.	268
Apparat, Inc.	108
Applied Creative Technology, Inc.	60
Applied Software Technology	248
Arlington Software Systems	123
Armonk Corporation	56
Arrix Logic Systems, Inc.	282
Artificial Intelligence Research Group	268
Ashton-Tate	8-9
Aspen Software Company	271
AST Research Inc.	57,81
Atara, Inc.	317
Automated Business Machines Inc.	162
Automated Simulations (EPYX)	73
BASF	7
Bay Technical Associates, Inc.	270
B.C. Systems Inc.	275
Beaman Porter	127
Best Programs	105
Binary Research	100
Bitstream	194
Blaise Computing Inc.	132
Blue Chip Software	140
Bottom Line, The	305
BSG	153
B.T. Enterprises	258
Business Master	270
Byad Inc.	IFC
Cactus Technology	249
California Micro Computer	267
Codex	286
ColorCorp	95
Columbia Data Products, Inc.	47
CompuShack (PDS)	134
CompuSoft Publishing	240
Computech Group Incorporated	26
Computer Advantages, Inc.	136
Computer Age of San Francisco	267
Computer Applications Unlimited	166
The Computer Book Club	253
Computer Case Company	291
Computer Control Systems, Inc.	190
Computerenergy	163
Computer Exchange	228
Computerized Management Systems	263
Computer Innovations, Inc.	94
Computer-Mate, Inc.	142-143
Computer Specialties	260
Computer Systems Design, Inc.	260
Computer Technology Innovations (CTI)	312
Computer Workshop	258
Computerworld International, Inc.	59
Computrickx Inc.	214
Condor Computer Corporation	139
Consultant Systems, Inc.	188-189
Context Management Systems	14,183
Contract Services Associates	199
Coosol, Inc.	256
Corona	154
Creativity Unlimited	266
Curtis Manufacturing Company, Inc.	292
Cybernetics, Inc.	64
Data Case Company	38
Data Consulting Group	269
Datamost	170
DataSource Systems	244
Davong Systems, Inc.	24
Daystar Systems, Inc.	89
DCT Corporation	266
Denberg Industries	209
Diamond Software Supply Co.	46
Digital Engineering Group	303
Digital Marketing	43
Digital Research	48-49
Disk Supply Co.	262
Distributed Computer Technology	287
Distributed Computing Systems	287
Don-El Computer Products	262
DP Computer Services	44
Eagle Software Publishing	247
Electronic Data Systems Corp.	144
Electronic Specialists, Inc.	261
Emerging Technology Consultants, Inc.	22
Engineering Science (OMICRON)	187
Entelekon	205
Escon Products, Inc.	135
Executec Corp.	133
Fantasia Systems Incorporated	261
Fast-Lane Management	312
Financier Corporation	116-117
Flagstaff Engineering	265
The Forth Circle	265
Fox & Geller	287
Fredericks Electronics (Plantronics)	79
FriendlySoft (FriendlyWare)	195,284
FTG Data Systems	61
Genie Computer Corp.	39
Gryphon Systems Software	197
H & E Computronics, Inc.	165
Hercules Computer Technology	68
Howard W. Sams	19
Howe Software	263
IBM	6
IB Magazette	129
ICR FutureSoft	227
Individual Software	273
Infocom	306-307
Information Unlimited Software, Inc. (IUS)	128
Inmac	268
Innosys Incorporated	155
Innovative Computer Products	303
Insoft	239
Intek Manufacturing Company	110
Intellect Associates	268
Intelligent Statements, Inc.	34,93
Interactive Tutorial Systems	130
Interface, Inc.	54
Intermedia Systems	251
International Software Alliance	230
Intersoft (Measurement Science)	145
Ipex International, Inc.	260
Ivy Research	260
Jack Strick & Associates	293
Johnson Associates Software	194
Jones Futurex	40
JPW Enterprises	293
Laboratory Microsystems	318
Leading Edge Products, Inc.	176-177,337
Lexisoft	84
Lifeboat Associates	315
Lifetree Software Inc.	20
Link Systems	107
Maynard Electronics	113
Med Systems Software	150
Memory Technologies Inc.	295
Mentor Computer Services	312
Metafile (Sensor-Based Systems)	186
Metasoft Corporation	254
MICROCOM	90
Microcomputer Business International	194
Micro Control Systems (MCS)	293
Microcorp	222
Micro Flash	262
Mic o-G	262
Micro Grip	259
Micro House	216-217
Micro Instructional Inc.	202
Micro Investment Software (MIS)	91
Micro Match	197

ADVERTISER	LOCATION
MicroRad Associates	92
Microsoft, Inc.	1
Miller Microcomputer Services	126
MicroWare	246
Mountain Computer, Inc.	11
Nat Hellman III Computer Accessories	76
National Software	267
National Technology Sales	125
NEC Information Systems, Inc.	175
Network Consulting, Inc.	69
N.F. Systems, Ltd.	259, 267
Norell Data Systems Co.	206-207
Olive Branch Software	166
Omric	257
Optimum Data Processing	258,300,328
Orchid Technology	203
Organizational Mgmt. Systems	265, 303
Owl Software Corporation	229
PBL Corporation	286
PC Cat	218
PC Connection	164,286
PCEZ Software	174
PC-Logic Systems	266
PC Software Inc.	35
(PC)2	62
Peachtree Software	158
Percom Data Company Inc.	55
Performance Engineered Programming	286
Periphex Inc.	91
Persoft Inc.	264
Personal Computer Software Specialists	97
Personal Systems Technology (Persyst)	198
Peter Norton	296
Princeton Graphics System	167
Printacolor Corp.	16
Professional Micro Systems	77
Pure Data Ltd.	103
Quadram Corp.	2-3,28
Quala	172
Quantum Software Systems (QUNIX)	71
Qubie' Distributing	231
QuCes	37,52
Quest Research, Inc.	264
Radio Technology	163
Random Access Corporation	184
Red Baron Computer Products	314
Relational Database Systems Inc.	234
Riverlake Systems	259
Robert J. Brady Co.	66
Rocky Mountain Software Systems	259
Satellite Software	263
Saturn Consulting	263
Scanoptik, Inc.	124
Seattle Computer	45
Sierra-on-Line, Inc.	185
Sigma Designs	274
Single Source Solution	221
SJM Methods, Inc.	180
Sofstar	120
Softrend Inc.	44
Soft Spot Micro Systems	313
Soft Supply Inc.	290
800 Software	138
Software 1040	42
Software Banc	41
Software Laboratories, Inc.	210
Software 'n Stuff	269
Software Solutions	27
Software Technology for Computers	250
Software Training Company	70
Solution Software Systems	264
Southeastern Software	114
Spectrum Software	173
Spinnaker Software	12-13
Squire Buresh Associates Inc.	264
SRA, Inc.	319
SSR Corp.	255
Stack Works	257
STB Systems, Inc.	152
Strictly Software	304
SuperSoft	74,242
Survey Systems Inc.	72
Symtec, Inc.	257
Systemics	243
Tallgrass Technologies Corporation	190
Tall Tree Systems	298
TCI Software	312
Techdata	270
Tecmar Inc.	OBC
TexaSoft	265
TG Products	208
Ticom Systems, Inc.	294
United Software	192
United Systems, Corp.	296
UOI Company	269
Vector Electronic Company	269
Visible Computer Supply Company	285
Vista Computer Company, Inc.	276
von Leivendyke Enterprises	161
VR Data Company, Inc.	272
Wesper Micro Systems	82
Westico Inc.	241
Westwood Software	215
Williams & Foltz	172
Willoughby Corp. (Max Software)	191
Xyquest, Inc.	196
Zen/Tek Corporation	255
Zobex	272

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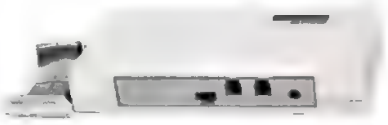
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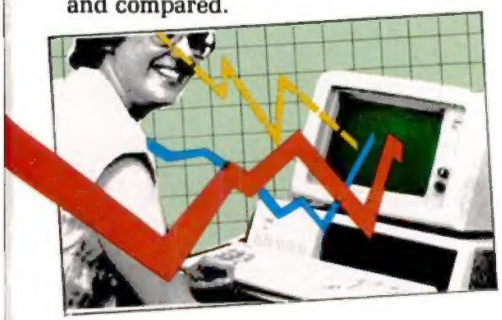
Coming Up

In Search of a Word Processor

Is there a good word processor for the IBM Personal Computer? PC put several major "wp" packages through their paces. Comparison charts are included. Word processors reviewed include *WordStar, EasyWriter II, Volkswriter, Benchmark, WordPlus,* and *Powertext.*

Which Letter Quality Printer?

The *PC* consumer guide includes the do's and don'ts of buying a letter quality printer. Several printers are reviewed and compared.



A PC Dow Jones Report

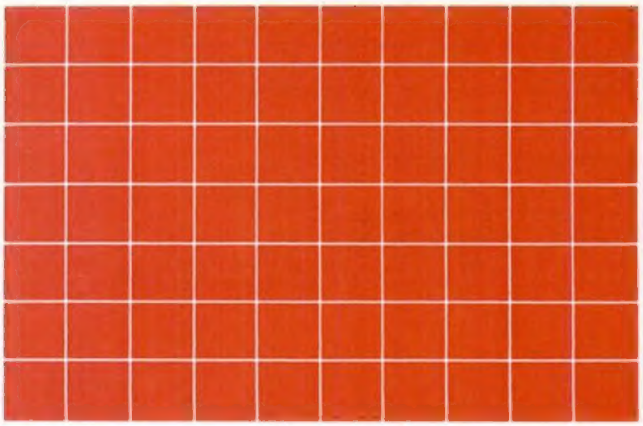
Financial writer Andrew Williams takes an in-depth look at the Dow Jones News Retrieval Service.

How I Love My Computer When it Checks My Spelling

A hard-hitting review of so-called spelling checker programs.

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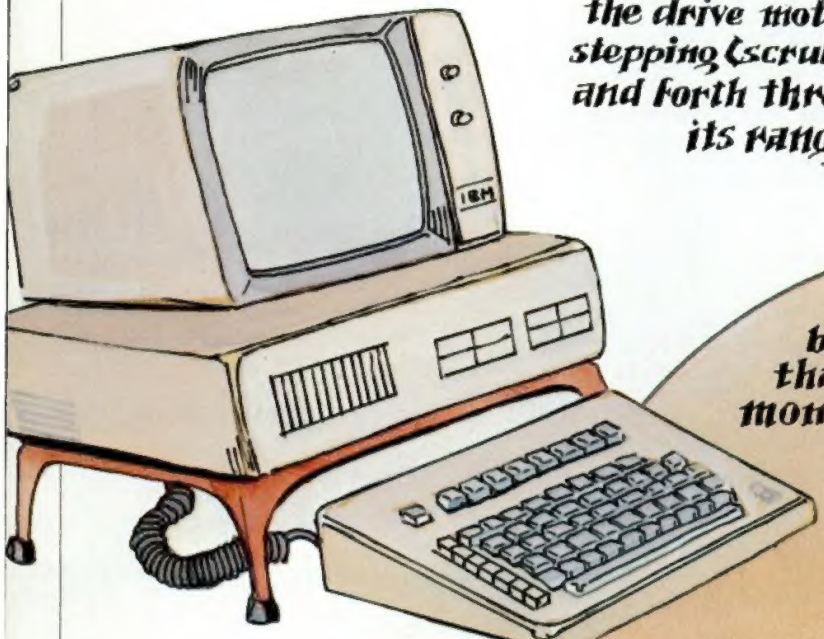
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Wish List



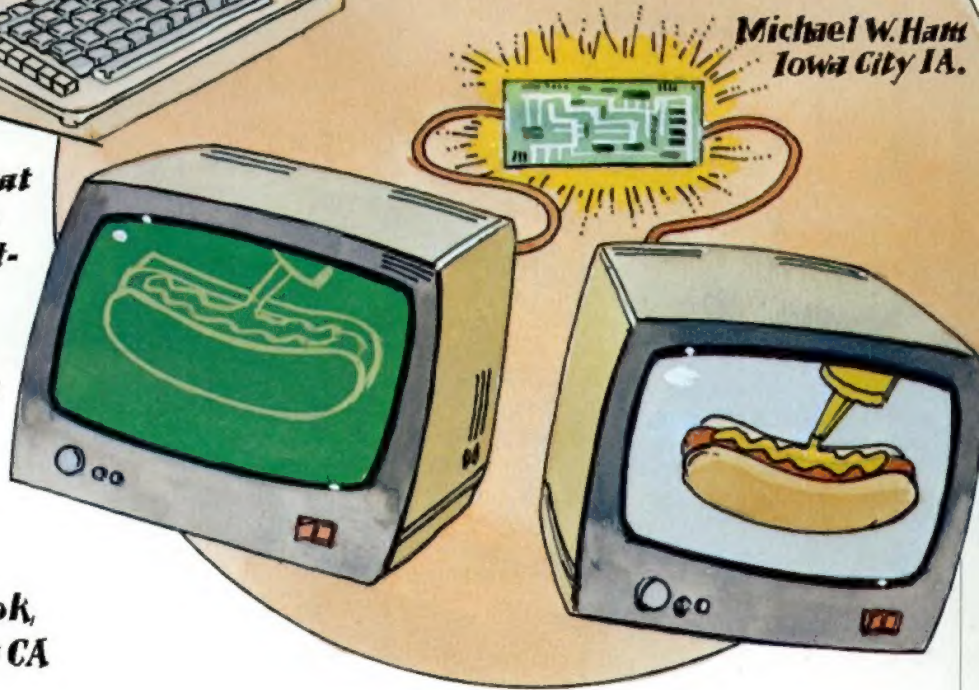
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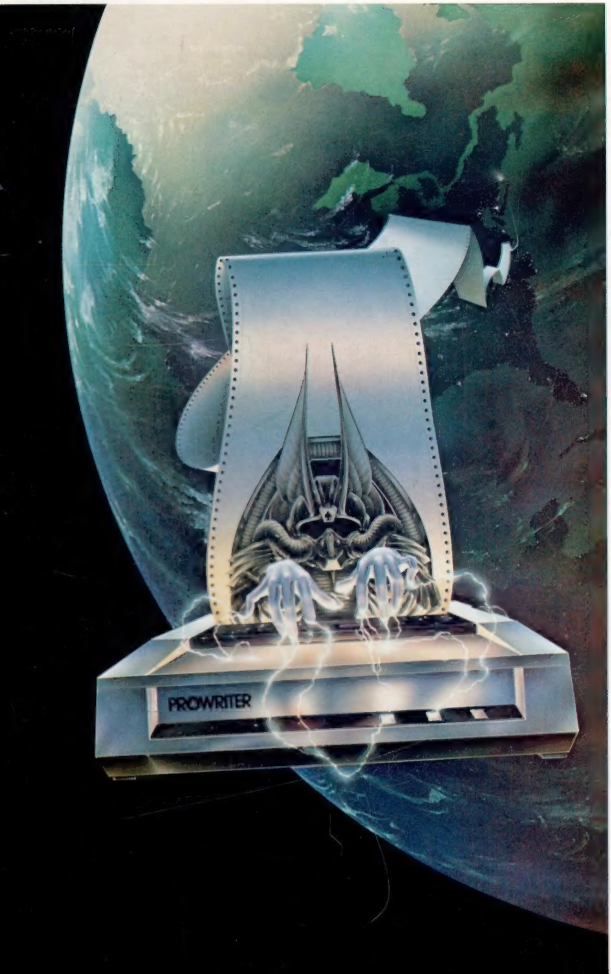
Illustration: Marc Ericksen

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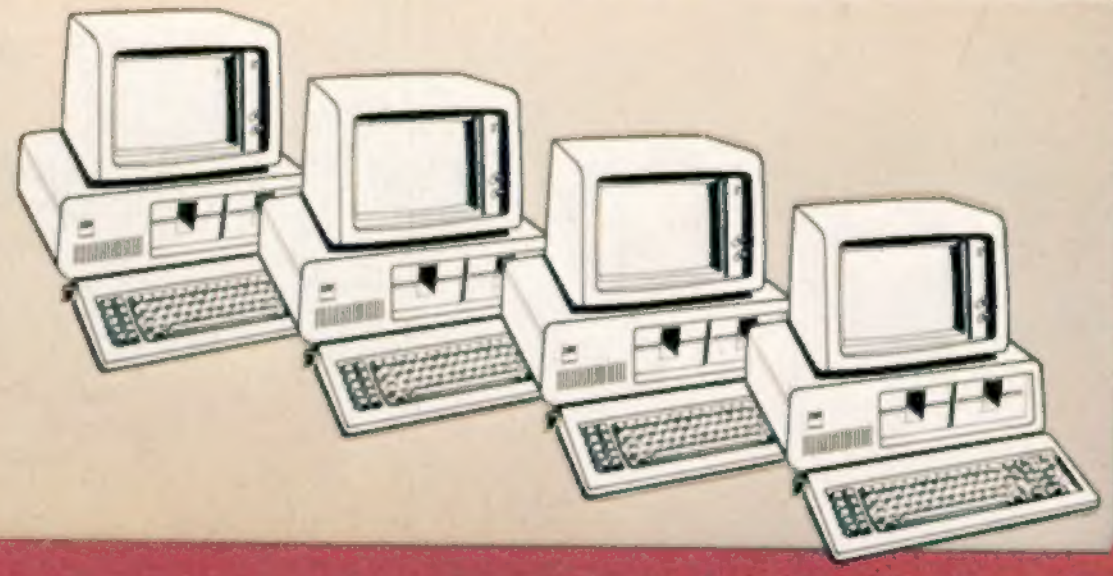
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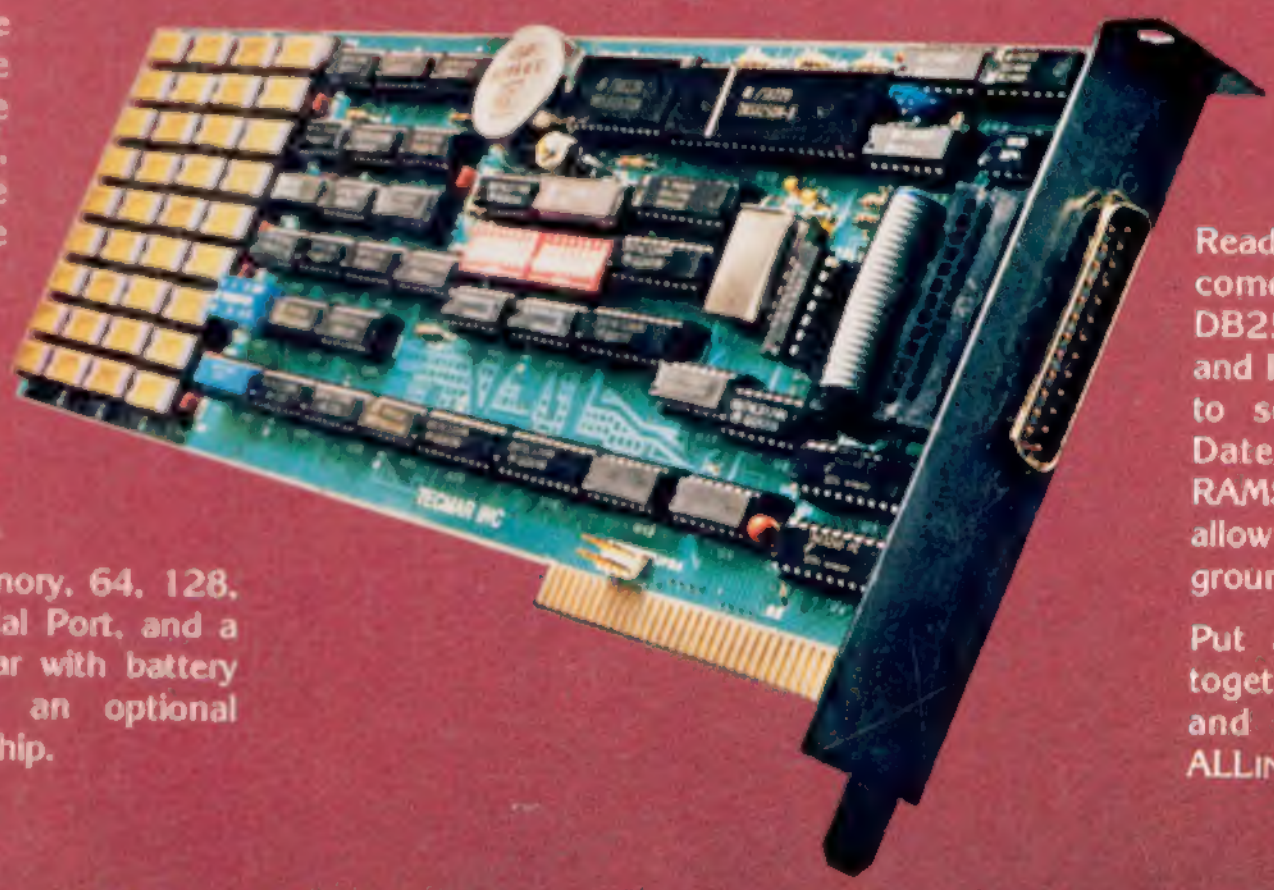
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